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THE 42D STREET SEWAGE TUNNEL, NEW YORK CITY.

The facility with which underground tunnels can be made beneath the streets of New York is strikingly exemplified in the boring of the now nearly completed tunnel which passes under East 42d street from between 3d and 2d avenues to the East river. The excavation has been made for sewerage purposes, and were it not for the small area of thoroughfare occupied by the enclosure about the shaft openings and the surface machinery, no one would be aware, so far as outside indications go, that the work was in progress. The cutting of 42d street through Prospect Hill is simultaneously proceeding, and while this extensive operation has been carried on on the surface, the tunnel has been run many feet below, so that most people, not being informed of the tunnel's existence, naturally infer that all the machinery, etc., visible, relates to the opening of the upper cut. So far as producing discomfort to the neighborhood is concerned, the last-mentioned work has proved a serious annoyance, and although when finished it will materially enhance the value of property, since its beginning it has rendered neighboring houses almost unrentable. The tunnel, on the other hand, while likewise benefiting property, has been productive of no inconvenience whatever.

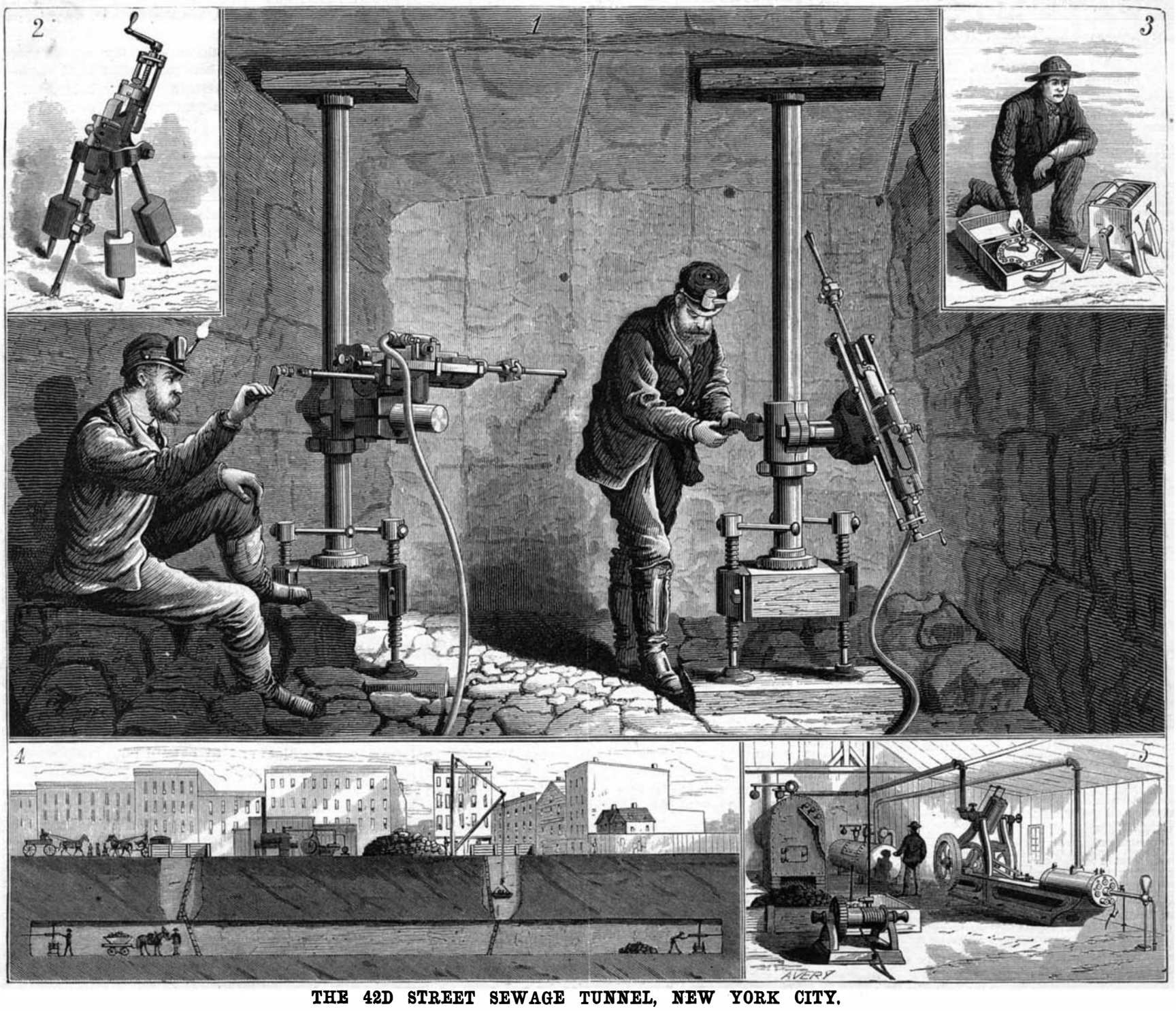
There is another remarkable feature about the subterranean work, and that is the rapidity with which it has been executed. It is eight feet square in section, and to be eighteen hundred feet in length. Twelve hundred feet are now finished, and have been accomplished in the short space of seven months. The rock is gneiss and quartz, and the machinery employed is the Rand Little Giant rock drill, driven by compressed air supplied by the Rand & Waring compressor. Five drills have been used, three constantly in action and two under repair. Fourteen holes are made in the headings before blasting, and the average advance is 6 feet per hole in 10 hours.

In the accompanying engraving we illustrate the Rand drill in operation in Fig. 1, the drill separately in Fig. 2, the exploding battery for firing blasts, Fig. 3, a section of the tunnel under 42d street in Fig. 4, and the interior of the compressor house, showing the compressor, etc., in Fig. 5. The compressor consists of a steam cylinder and its piston connected with a double-acting compressing cylinder and its piston, the connection being made to one and the same revolving shaft by a crank pin common to both. The steam end consists of an oscillating steam engine placed obliquely and so arranged that at the moment of greatest resistance of the compressed air, the greatest effort of steam is applied. The air compressing cylinder is composed of three concentric shells, which form two annular spaces around the working cylinder; the outer space affords a passage for the air after compression, and also a vessel for collecting any moisture that there may be in the air; the inner space forms passages for the water used in cooling. The heads of the cylinder, the piston and piston rod, are also hollow, to admit a flow of water through them. The essential feature of the entire machine is the system of circulation, which places a current of flowing water behind every part of the compression machinery with which the air comes in contact during compression, while cold water is continually supplied as fast as it is required.

The principal point in the construction of the Rand drill is its simplicity. It is claimed to have a less number of parts than any other machine of its class. By a simple device the valve is thrown in the same direction as the piston is moving, without the use of a connecting rod, or any cumbrous machinery outside the steam chest or cylinder, thus obviating the constant stoppages for replacement. The port is not closed until the drill has made the full stroke, thus bringing to bear the full force of air or steam in doing the required work.

The drills are intended to be used with either the column or tripod. In vertical work the latter is more suitable. Its legs are arranged to telescope, and can be lengthened or shortened at will, thus allowing holes to be bored in very difficult places and at almost any angle. Another advantage claimed for the drills possess over the old system of hand work, is not only in the economy of time and labor, but in the saving of material used. The drill, or bit, being an integral portion of the blow-delivering power, is exhausted only at one end instead of having both flattened—one by the resistance of the rock and the other by the powerful blows from a sledge hammer, which last itself enters into the list of materials consumed.

The Rand drills weigh from 150 to 900 lbs., there being six sizes, the smallest drilling from ½ to 1 inch holes, and especially for plug and feather work, the largest boring 3 to 4 inch holes, 30 feet deep, and intended for deep cuts, large apertures, and the heaviest class of rock work. The machines may be driven by either steam or compressed air, but the tunnel above referred to is an instance of the advantages attending the use of the latter underground. In so confined a space, where there is no exit for the exhaust steam, it would be practically impossible for men to work;



THE 42D STREET SEWAGE TUNNEL, NEW YORK CITY.

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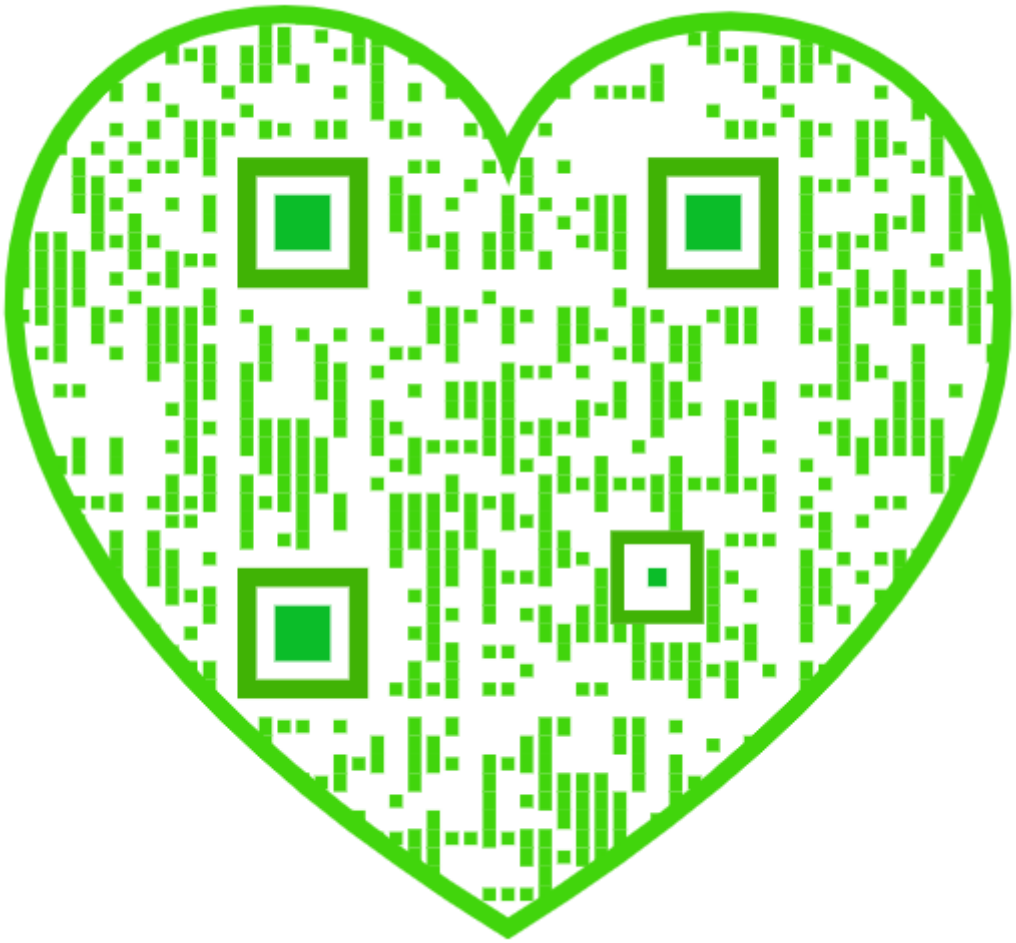

compressed air, on the contrary, suffers no such diminution of pressure on being carried over long distances, as does steam; and its escape serves to ventilate the tunnel.

The Rand drill is in use in a large number of mines, etc., throughout the country, notably those in Port Henry, N.Y. the Comstock mine in Nevada, the Lehigh and Wilkesbarre Coal and Iron Company's mines in Nevada and elsewhere. For further information relative to both drills and compressors, address

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$80,000 REWARD FOR A CURE FOR CHOLERA.

By a will dated August 28, 1849, a French gentleman named Bréant left to the Paris Academy of Sciences the sum of $80,000, to be awarded as a prize to any person who should either discover a cure for Asiatic cholera, or the cause of the disease. He further directed that the interest of this fund, until the principal was finally awarded, should be donated as premiums to investigators who should contribute important information tending to advance knowledge relative to the malady. The rules of the French Academy, under which the prize will be awarded, are as follows. The competitor is required:

(1). To point out a system of medicine that cures cholera in the immense majority of cases; or

(2). To indicate, in an incontestable manner, the causes of Asiatic cholera, so that, by suppressing these causes, the epidemic will cease; or

(3). To discover some certain prophylactic as evident for cholera, as, for instance, vaccine is for small-pox.

(4). To become entitled to the annual prize (derived from *the interest* on the $80,000), the competitor will have to demonstrate, by rigorous processes, the existence in the atmosphere of substances that may play a part in the production or propagation of epidemic diseases; and

(5). In case none of the above conditions have been fulfilled, a competitor may take the annual prize by finding a radical cure for tetters, or enlightening the world upon the etiology of that disease.

The existence of this reward has been the cause of an immense amount of medical research, and hundreds of papers have been submitted to the Academy. The great prize has never been awarded, and probably it never will be, for before the cause or the cure of Asiatic cholera can be discovered, the malady itself, owing to our constant progress in knowledge of preventive sanitary precaution, will probably, like the plague, have disappeared altogether.

During the present year, we learn from the English *Magazine of Pharmacy*, nine papers have been sent in. None have been adjudged worthy of the $80,000, but as the interest may be bestowed annually upon any person "who shall have caused science to progress, as regards cholera or any other epidemic disease, either by giving better analyses of the air, and showing therein some morbid element, or by discovering some process enabling us to become acquainted with, or investigate, the animalculæ which, up to the present time, have escaped the eyes of the learned, and which may be the cause, or one of the causes, of the disease."

Portions of the revenue have been awarded—on two of the nine papers. The first of the successful pair is by Dr. Duboué, of Pau, and he endeavors to demonstrate that the primitive lesions consist in a disquamation of the endothelium of the small vessels, and of the epithelium of the various membranes, particularly that of the intestine, and he attributes this disquamation to the influence which the morbific agent of cholera, after it has penetrated into the system by the capillaries of the lungs, exerts upon the epithelial cells and the intercellular substance. For explanation of the various phenomena of cholera, according to this theory, Dr. Duboué was awarded a prize of $400. The other fortunate competitor was Dr. Stanski, of Paris, who forwarded a large number of pamphlets, wherein he endeavored to demonstrate that contagion at a distance by miasma, or, in other terms, infection by means of a volatile principle, has no existence in any disease whatever. For this contribution a prize of $200 was given.

We believe that the existence of this prize is little known in this country, and as cases of cholera have been of frequent occurrence in some localities South, and also have been closely and intelligently studied by the physicians of that section, we have no doubt but the American medical profession, if it does not possess some member who may secure the prize, at least numbers many who can contribute materially to general knowledge concerning the disease.

SUN SPOTS STUDIED BY SOLAR PHOTOGRAPHY.

M. Janssen has obtained magnificent photographs of the sun, measuring some 12 inches in diameter, on which the granular solar surface can be as clearly distinguished as by regarding the sun through the largest instruments. He obtains these by diminishing the time of exposure to less than $\frac{1}{300}$th of a second and employing special means for the development of the image.

On April 14th last, M. Janssen states that a photograph of the sun showed no spots, and it was therefore reasonable to presume that none existed, as spots as small as one second in diameter were always registered. On the next day, at about 8 A.M., another photograph showed, near the center of the sun, a considerable group of spots, the largest of which measured some 20 seconds in diameter. M. Janssen points out that, as the earth when seen from the sun is but 18 seconds in apparent diameter, our globe could easily have been contained within the area of the largest spot. The suddenness of the apparition and the grandeur of the phenomenon led the observer to predict the prompt disappearance of the spots and frequent changes in their configuration. He further concluded that the idea that, when the sun (as at present) exhibits few spots, that it is undergoing a period of repose is inexact, but that the truth is rather the reverse, as spots then form and vanish with a rapidity much greater than at any other epoch.

Of course these views of M. Janssen have led to many observations and much discussion by and among astronomers. M. Denza cites a small spot which appeared on March 6th and disappeared before the 12th; the same observer notes the fact that the spot of April 15th formed on the afternoon of the 14th. M. Ventosa at Madrid also saw the spots form at 5 P. M., on the 14th, and mentions seeing other smaller spots appear and vanish rapidly during previous months.

M. Gazan dissents from M. Janssen's views, and regards sun spots as the result of eruptions in the solar mass. Before the spot, however, there are faculæ which should have been seen. In the photograph of April 14th, however, faculæ are altogether absent, but this M. Gazan explains by assuming that the faculæ were too near the center to be visible. According to him the spot in question will not disappear any more rapidly than spots during the maximum epochs, and he thinks that it will return. M. Janssen, however, replies that fifteen days afterward, when the sun had more than completed his semi-rotation, the spot should, according to M. Gazan, have reappeared, whereas it did not.

M. Tacchini does not coincide with M. Janssen in the idea of the present activity of the sun, but on the contrary considers that an actual period of repose exists. He points out that there were 290 spots observed within five months in 1871, while but 24 were noted in the same period in 1876.

M. Janssen states that the first mentioned total is exaggerated, for several spots which appeared three or four times were counted as frequently, and that numerous small spots could not appear and disappear rapidly, as is the case now, without producing excessively violent movements in the solar mass. This very great activity would militate against the formation of spots and be favorable to the disappearance of those already produced.

CEREBRAL THERMOMETRY.

At a recent meeting of the French Medical Association at Havre, M. Broca laid before it the results of a prolonged investigation into the temperature of the surface of the head in health and disease. He employed an instrument of which the bulb was maintained in contact with the cranium, whilst its opposite surface was thoroughly insulated from external air. As a rule, he placed three of these thermometers on each side of the head, and thus obtained readings at six different points. A normal standard was obtained by experiment from healthy individuals. Twelve persons were taken. The maximum temperature was 94·73° F., the minimum 91·04°, giving a mean temperature of 92·87.° The thermometers on the left side registered two degrees higher than those of the right, when the brain was passive; when active an equilibrium was at once established. From this, Mr. Broca inferred that the blood supply is more abundant to the left than the right hemisphere; but when the brain is called into activity, the right hemisphere, being, as it were handicapped, calls for a greater supply of blood than the left. The reading of a book raised the temperature one degree.

LESSONS IN MECHANICAL DRAWING.

The very admirable series of Lessons in Mechanical Drawing which have been serially published in the SCIENTIFIC AMERICAN SUPPLEMENT is now approaching its termination. The first of these lessons appeared in No. 1 of the SUPPLEMENT and in it the author, Professor C. W. MacCord of the Stevens Institute (himself perhaps the ablest mechanical draughtsman in the country) entered upon his subject in a manner not only entirely novel but in a way which could not but prove to the student that the subject was to be treated with a comprehensiveness and thoroughness never before attempted in any work, and certainly never essayed in any periodical journal. Professor MacCord began by teaching the beginner how to make his own instruments, starting out with a couple of triangles to be cut out of pasteboard, and showing how much might be done with these simple aids. Then followed instructions how to make lines and angles and to combine them into various geometrical patterns. In lesson 7, he reached the employment of the compasses and the first introduction of circular forms, and thus he proceeded, taking up the various instruments and clearly elucidating their uses. The first thirty-two lessons completed the elementary portion; and whoever had mastered the principles and faithfully practiced the exercises presented in the large number of drawings, which were accurately prepared by the author himself, was then in a position to place the knowledge acquired of mechanical drawing to the test of practical application in its legitimate sphere, namely the actual draughting of machinery. The new series began with the draughtsman's scale and its uses, and the learner was at once inducted into the drawing of simple forms, such as bolts, nuts, links, and all the various parts of machines and so onward until in the most recent lessons the construction of the screw propeller has been elucidated.

That the lessons have proved of practical value we have the direct evidence of a number of correspondents who have written to us telling us of their progress, and also by their questions showing how intelligent an interest they feel in the same. Some have sent us capitally executed drawings as proof of their attainments. One writer informs us that he has practised but for two months on the lessons extending to No. 5 in the second series, and that, although he had no previous knowledge of draughting, he has acquired sufficient skill to enable him to prepare patent office drawings, so that he now is making money out of the valuable education he has obtained from the SUPPLEMENT's pages.

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The aggregate material we have furnished, with the engravings, would fill a good sized volume, which alone would cost more than the subscription price of the SUPPLEMENT for the period over which the lessons have been published, or much more than the cost of the numbers of that journal containing the lessons, which can now be separately or collectively furnished.

THE GLANDULAR THEORY OF DISEASE.

Some ten years ago Doctor B. W. Richardson made the discovery that the fluids secreted during the various stages of some forms of communicable disease could be made to propagate disease. This he practically proved by producing hospital fever in an animal by introducing into a wound purposely made the secretion of a wound from a person suffering from surgical injury. Subsequently the secretions from that animal transmitted the disease to another, and it was thus propagated through four generations. Dr. Richardson then essayed to isolate the poisonous matter and succeeded in producing a darkish somewhat powdery half glistening mass closely resembling that obtained by drying the fluid which exudes from the cut poison sac of any venomous snake. To this substance he gave the name *septine* and classified diseases produced by it as *septinous* diseases, and in searching for a theory to account for the phenomena observed he came to the conclusion that the secretions of the animal body are the sources of the septinous diseases and that the latter are all of glandular origin; that in every case of disease the poison producing it is nothing more and nothing less than a modified form of the salivary, gastric or some other secretion. The diseases so produced are small pox, measles, scarlet fever, diphtheria, typhus, yellow, hospital, typhoid and puerperal fevers, erysipelas, cholera, ague, glanders, boils and carbuncles, and infectious ophthalmia. Dr. Richardson's other chief conclusions may be briefly summed up as follows: So long as a person is affected with these organic poisons and is giving off vapor at a certain temperature he is poisonous. The poisons are mechanically carried and distributed by the vapor. They are harmless in the dry state but commence to resume their activity in water. They may all be destroyed by extreme dilution, by heat, by exposure to moist oxygen, to chlorine, iodine, bromine, sulphurous acid and nitrous acid in less degree. Bright sunlight is a potent means of their destruction. They are preserved by cold and by sulphur, creasote, and arsenic, so that they keep their active properties. They do not multiply like germs, but each particle possesses the property of converting certain secretions of the living animal into itself. The poison may travel as dry solid matter in sewage, or be wafted through the air, or in linen saturated with secretions, or may exist in water or watery vapor.

In a recent address, before the Sanitary Congress at Leamington, England, Dr. Richardson reverted to this theory and brought forward the result of his most recent investigations in its support. He states that he has noted that the number of closely communicable diseases is intimately related to the number of secretions. The poison of hydrophobia is from the salivary secretion, of diphtheria from the mucous glands of the throat, of scarlet fever from the lymphatic glandular secretion, of glanders from the mucous secretion of the nasal surface; of typhoid from the mucous glands of the intestinal surface, and so on. In some instances the blood itself is infected and the corpuscular matter becomes the seat of a catalytic change.

Dr. Richardson now thinks that the poisonous particles instead of being living are dead, and that their evil effect depends on their so being. He also advances the view that, under certain influences affecting glandular action, the poisons may be made to originate directly through nervous impression without the necessary intervention of an infecting particle. An extreme nervous impression (such as is the case where a prevailing disease can only be traced to extreme fear or anxiety) acts on the glandular nervous supply, paralyses the glandular function, and thereupon produces the same phenomena as is produced in other instances by the action of a specific poison. This accounts for disease and poisonous glandular product under conditions of starvation and cold when the nervous tension is reduced, as well as under special atmospheric conditions in which the activity of the atmospheric oxygen is reduced in sustaining power. The poisons act first on the nervous fiber and the irritation caused gradually extends to the nervous center. This is what slowly takes place in hydrophobia. Another conclusion is that the communicable diseases are hereditary, and still another sequence of Dr. Richardson's researches leads to the explanation of the phenomenon of non-recurrence of the diseases after they have once attacked a person susceptible to them. They who are susceptible are born with a nervous impression tending to the production of a glandular secretion easily changed into poisonous secretion under the direct action of contact with poisonous matter or even under the influence of a central nervous derangement whereby the glandular function is deranged. But when such a person has passed through the ordeal, the tendency, for a time at least, disappears, owing to the complete modification of the glandular function that has been induced, to the free elimination that has been established and probably to the change in the nervous matter itself that has resulted from organic modification.

Dr. Richardson considers that if this theory be true we have complete mastery over the diffusion of the poisons of all the communicable diseases. A man or animal affected with a contagious disease is as deadly as the cobra, and he should be isolated and care be taken that his secretions, volatile, fluid or solid, do not come in contact with the secretions of susceptible healthy persons, and the danger is over. The theory, says the author in conclusion, suggests a profitable line of research on the subject of the production and reproduction of some of the poisons by the inferior animal and their transmission in that course to man. It brings all the inferior animals, in respect to their health and comfort, under our especial human care, not only for their sakes, but for our own self-preservation.

Finally, the theory suggests to those who are engaged in treating diseases of a communicable kind the best means of arresting the progress of a communicable disease even when the phenomena of it have been developed in an individual. It leads physicians to take a precise view, in each such case, of the nervous and glandular processes that are out of the natural order of work; it suggests seeking for remedies among chemical agents which affect special secretions; and it shows how to place the sick under such conditions that the secondary absorption of their own poisonous secretions—that deep absorption which is the actual cause of death in the great majority of cases of contagious disease—may be avoided.

NOTES OF DECISIONS OF THE COURTS.

ARTIFICIAL TEETH.—The bill of complaint filed by the Goodyear Dental Vulcanite Company against Charles G. Davis and others, for an infringement of the Cummings patent for "an improvement in artificial gums and palates" has just been dismissed by Judge Shepley.

It will be remembered that the Cummings patent is not for a process or art, but only for the product or article made by the process described. This product is a set of artificial teeth, consisting of a plate of hard rubber or vulcanite, with teeth or teeth and gums secured thereto by imbedding the teeth and pins in the vulcanized compound, so that it shall surround the teeth and pins while the compound is in the soft state before it is vulcanized. When the compound is vulcanized, the teeth are firmly secured by the pins embedded in the vulcanite, and there is a tight joint between the vulcanite and the teeth.

The plate is formed by filling a plaster mould with soft rubber, care being taken that the soft rubber shall completely fill all the cavities, and fit around the protuberances, including the pins projecting from the teeth. The soft rubber thus inserted in the mould is then subjected to sufficient heat to vulcanize or harden it.

The defendants use, in making their set of artificial teeth, a plate made of "celluloid," substantially a new material, discovered and patented since the date of the Cummings invention. This substance is compounded of cellulose or vegetable fiber and camphor. No rubber or other equivalent gum, and no sulphur or equivalent for sulphur in the process, enter into its ingredients. It is not a vulcanizable compound, and contains no vulcanizing agents in its composition. The camphor in its composition, instead of being a vulcanizing agent, causes the composition to soften instead of harden under the influence of heat. The product, when compounded, and before being subjected to heat, is not soft, like soft rubber under like conditions, but hard. In the manipulation of this material, the process of making a set of teeth, composed of the plate and teeth and gums, is an entirely different process from that used under the Cummings patent. The material is not placed in the mould in a soft, plastic condition, but in a hard, rigid condition, like horn, or bone, or ivory. It is then subjected to heat, not to vulcanize or harden, but to soften it. It afterwards, on being cooled or restored to its original temperature, returns to its original condition as a hard substance, as when first placed in the mould. No vulcanizing process, or even process of hardening by heat, and no equivalent for any such process, is practiced.

The court, in the light of such facts, holds that the Cummings patent for a plate of hard rubber or vulcanite is not infringed by a plate made of celluloid.

DYNAMITE. The Atlantic Giant Powder Company have been successful in maintaining their suit against George W. Mowbray and others for infringement of the so-called dynamite patent of Nobel. This patent was for an improvement in explosive compounds, consisting of the combination of nitroglycerin with infusorial earth or other equivalent substance.

For a long time after the invention of nitroglycerin by Sorbrero in 1847, in fact until 1863, when Nobel's inventions began, although nitroglycerin was well known to be a very powerful explosive as compared with gunpowder and gun cotton, it was very little used for blasting purposes. This delay in the introduction of nitroglycerin as an explosive to practical use was due apparently, first, to the enormous danger to life and property attending its manipulation, transportation, and use, in its fluid state; and secondly, to the practical difficulty, amounting almost to an impossibility, of exploding the whole mass of fluid nitroglycerin, as no instantaneous decomposition of the whole mass follows from the application of heat or of a blow, as in the case of gunpowder or gun cotton when fire is applied. The object of Nobel's dynamite patent was to remedy the first objection of enormous danger to life and property, and to combine the nitroglycerin with some absorbent substance, whereby the condition of the nitroglycerin is so modified as to render the resulting compound more practically useful and effective as an explosive, and far more safe and convenient for handling, storage, and transportation, than nitroglycerin in its ordinary condition as a liquid. The invention is described in general terms to "consist in mixing with nitroglycerin a substance which possesses a very great absorbent capacity, and which at the same time is free from any quality which will decompose, destroy or injure the nitroglycerin or its explosiveness." A certain kind of silicious earth, known under the several names of silicious marl, tripoli, rotten stone, etc., the preferred variety being infusorial earth, is described as the inert matter to be mixed with the nitroglycerin.

The defendants used mica powder, which is prepared by pouring tri-nitroglycerin at a temperature of 70° over mica scales prepared by triturating mica into scales of about one thousandth of an inch in thickness, and of exceedingly minute surfaces, in such a manner that the surfaces of the minute mica scales are painted or coated with the tri-nitroglycerin.

It is true that the infusorial earth is described as a porous substance, and is supposed to hold the nitroglycerin suspended in the pores by capillary attraction, but it must also hold it in suspension by coating and adhering to the exterior surfaces of the particles. The mica scales, on the other hand, are supposed to hold the nitroglycerin in suspension only as it is painted or coated on the exterior surfaces of the minute scales; but they each perform the same function as an absorbent of the nitroglycerin. They each take up and hold, by cohesive or molecular action or reaction, the nitroglycerin. The mixture is a mechanical one, and it is not material to the functions of the compound or its properties whether the liquid is held absorbed or suspended in the inner surfaces of minute capillary tubes, or on the outer surfaces of minute scales. Each one of the properties and qualities, ascribed by Nobel to the inert matter in his compound, pertains to the mica scales in the mica powder, and the functions are the same in each. In regard to the nitroglycerin used, Nobel used mono- or di-nitroglycerin, while the defendants used pure tri-nitroglycerin. In strictness, either by the old or the new system of chemical nomenclature these substances would be differently described or represented, but for the purposes of the compound they must be regarded as substantially the same in kind, though differing in degree.

Mica powder is therefore an infringement upon Nobel's dynamite.

The Relation Between the Diameter of Cores of Electro-Magnets and Their Length.

M. du Moncel has recently communicated to the French Academy of Sciences a paper on the above subject, the conclusions reached in which are as follows: 1. The dimensions to be given to an electro-magnet should essentially depend upon the electric force which is to affect it and upon the resistance of the circuit in which it is interposed. When the circuit is long and the electric source weak, the cores should be long and of small diameter: when, on the contrary, the circuit is short and the electric force intense, the core should be of large diameter. 2. For equal circuit resistances, the diameters of an electro-magnet established under maximum conditions should be proportional to the electro-motive forces. 3. For equal electro-motive forces, these diameters should be inversely as the square root of the resistance of the circuit, the resistance of the battery being included. 4. For equal diameters, the electro-motive forces should be proportional to the square roots of the resistances of the circuits. 5. For a given electro-motive force and with electro-magnets placed in their maximum conditions, the electro-motive forces of the batteries which excite them should be proportional to the square root of the resistances of the circuit.

A Simple Method of Ventilating Rooms.

Dr. H. N. Dodge informs us that he has found the following plan very satisfactory for the ventilation of rooms that are much used during cold weather: Nail or screw a neat strip of wood, from one to two inches high, upon the window sill, just inside of the sash and extending entirely across from one side of the window frame to the other. Upon the top of this strip fasten a piece of ordinary "weather strip," so that there will be formed an air-tight joint between the "weather strip" and the lower sash of the window, whether the latter is shut down tight or raised an inch or two, the lower cross-piece of the sash sliding on the rubber of the "weather strip" as the sash rises. With this simple fixture in place, the lower sash may be raised enough to admit a stream of air between the lower and upper sashes, where they lap over each other at the middle of the window, without admitting the least air at the window sill. The air admitted between the sashes is thrown directly up toward the ceiling, and there mixes with the heated air at the upper part of the room. The room is thereby ventilated in a thorough and agreeable manner without drafts of cold air upon the persons in the room. The fixture should be applied to several windows in a room. The amount of ventilation may be regulated by the distance that the lower sash is raised. This arrangement is cheap, simple, and effective.

Cast Engravings.

A cheap way of reproducing engravings is to use cast plates, which may be worked off on a common printing press. An alloy of tin 1 part, lead 64 parts, and antimony 12 parts, is poured, while in a state of fusion, over the engraved plate, which is raised on suitable supports.

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IMPROVED TILE-MAKING MACHINE.

The annexed illustrations, which we take from the *Agricultural Gazette*, represent a new continuous-feed, brick, pipe, and tile making machine of English construction. Machines of this pattern for solid bricks only have been in use for a considerable period; but in the present apparatus not only solid, but perforated, hollow, or tubular bricks, roofing tiles of all descriptions, paving bricks, and drain pipes up to 12 inches in diameter, may be made.

The clay is both ground and pugged in the upper part of the machine. Thence it passes to the lower horizontal cylinder, whence it is expressed around a core, if for tiles or other curved forms. The material then slides upon the table on the surface of which are horizontal rollers, and passes (if in the form of solid bricks) between the vertical rollers shown. The tiles or bricks are separated by means of the wires placed in the movable frame shown.

Fig. 1 shows the arrangement of the machine for producing solid bricks, and Fig. 2 the construction for tile making. The apparatus is self-contained and can be put down anywhere in a very short time without skilled labor. It is mounted on wheels so as to render it portable; and can be opened by simply removing a few bolts so that the interior of the mill is readily accessible. The power required is stated to be 4 horse power nominal, and the capability of the machine 15,000 bricks per day.

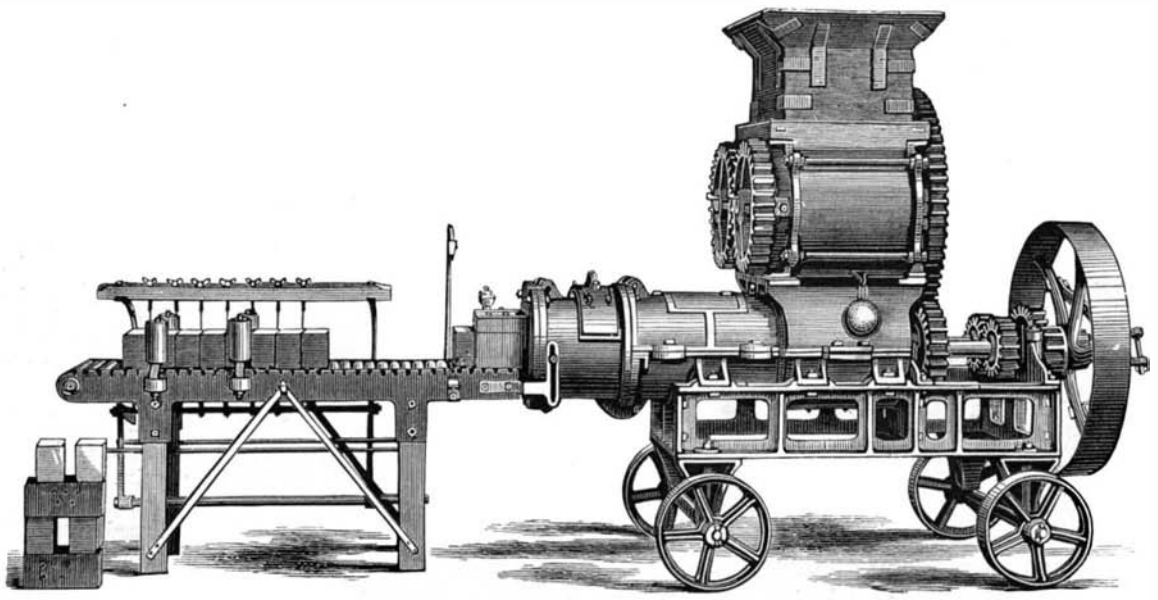

Fig. 1.—NEW TILE-MAKING MACHINE.

The Increase of Near-sightedness.

It is undoubtedly true that there are far more near-sighted people in proportion to numbers at the present time than there was fifty or a hundred years ago. This increase is due to greater habits of reading, the necessities of education, lateness of hours kept, gas light, and many other causes which our forefathers did not have to contend with. Advanced civilization makes every day greater demands on the resources of human nature, and yet we are no richer in merely physical wealth than the generations before us. Unless civilization shall teach us methods of husbanding our strength, or of increasing its power, we may in the end come to a dead stop, for our faculties will no longer be able to do the work required of them.

Dr. E. G. Loring lately delivered an address before the New York County Medical Society on the subject, "Is the Human Eye gradually changing its form under the influence of Modern Civilization?" He points out that constant study creates short-sightedness, and heredity often perpetuates it, hence the number of short-sighted persons must necessarily increase in a nation devoted to intellectual pursuits. In considering the effect of prolonged use and overtensions of the eyes, Dr. Loring examined 2,265 eyes of scholars in the New York public schools. The proportion of normal eyes was 87 per cent among those under seven years of age, and 61 per cent in those above this age but under twenty-one. The proportion of near-sighted eyes in the younger was 3·5 per cent, and in the elder 26 per cent. In St. Petersburg, among the same classes, the proportion is respectively 13·6 per cent and 43·3 per cent, and in Königsberg, Germany, 11·1 per cent among the younger, and the enormous figure of 62·10 per cent among the elder class. Thus there is an increase of near-sightedness with the advancing years of the school term. It is more common in Eastern and older cities than in Western ones, and among the cultivated classes than the uncultivated. In New York city the percentage is 24 among Germans, 19 among Americans, and 14 among the Irish. Poor food, bad ventilation, and disregard of other hygienic requirements and a sedentary life—all of these conduce to a laxity of tissue which finds its expression in the eye.

The English are less troubled than other nations, probably because of their passion for outdoor games, which are decidedly beneficial to the sight. Near-sightedness is a disease of childhood, and rarely begins after the fifteenth or eighteenth year. The reason why there is less near-sight among people using their eyes in minute mechanical work is because of this rule. Different examiners have found about 10 per cent of near-sighted people among watchmakers and 70 per cent among the studious. "The only method," said Dr. Loring, in conclusion, "of preventing near-sight is to lessen the amount of work done by school children during the period of life from eight to sixteen years. It is by complying with these conditions that the English have become so eminently a literary people."

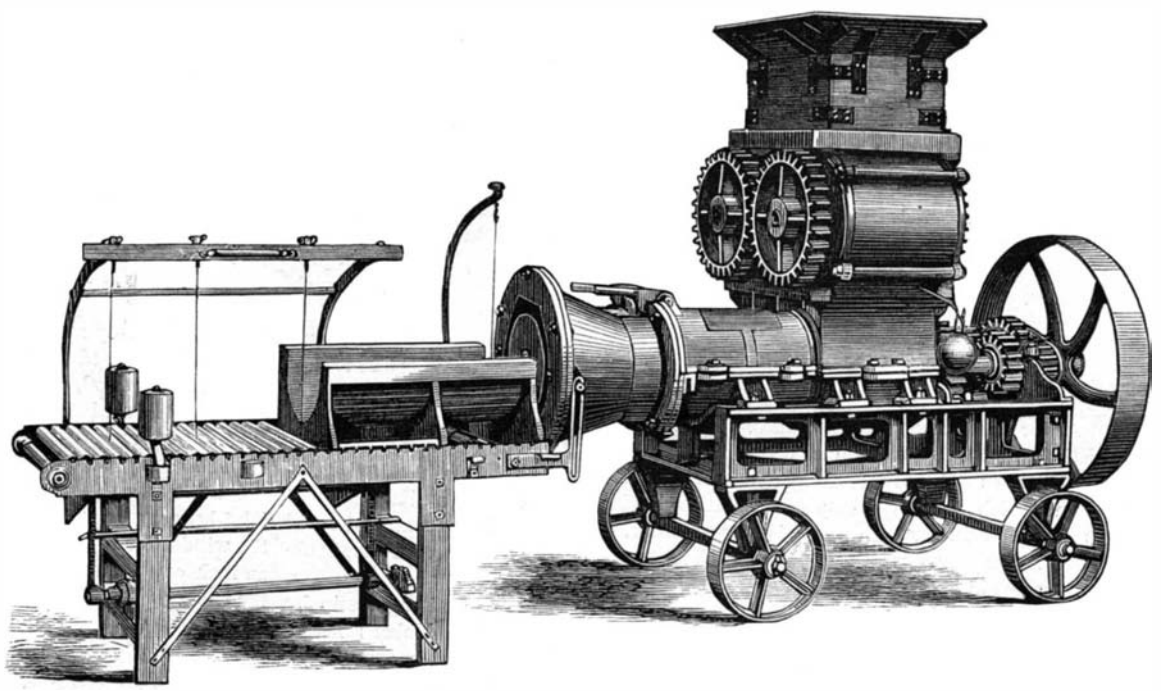

Fig. 2.—NEW TILE-MAKING MACHINE.

These suggestions are certainly worthy of consideration by parents, who may be hereafter more indulgent to their children when nature prompts them to avoid what it knows to be injurious. After the sight is firmly established an increased amount of study may make up for lost time.

New Mode of Purifying the Water of Condensation.

Water from the condenser aboard sea-going vessels, although fresh, is often found unsuited for both the purposes of drinking and as feed water. Under the influence of highly heated steam, the oil which lubricates the slides becomes saponified, yielding glycerin and fatty acids, and among the latter oleic acid. Water tainted with oleic acid is extremely disagreeable to the palate, and it also has the property of attacking boiler iron, forming an oleate, which in two French government vessels has recently been found to develope at the rate of over 400 lbs. a day. This substance causes very rapid deterioration of the boilers, and produces deposits, the evil effects of which are well known.

M. Etais has lately conducted some experiments on board of a French man-of-war, which indicate that a method he has discovered of avoiding the above difficulties is both practicable and useful. He simply passes the water of condensation into a reservoir containing lime water. The oleic acid then enters into the formation of oleate of lime and the water is purified.

PORTABLE corrugated iron huts, capable of accommodating each from 25 to 500 men, are in use instead of tents, by the Russian army.

Drawings for the Workshop.

Construction drawings after use in a workshop are liable to be soiled and torn and rendered undesirable for filing in the systematic drawers of a drafting office. Hence in many establishments it is deemed expedient and economical to make duplicates, so that a clean drawing can be always had for reference and office use. When a duplicate is desired, an easy and good method is to make it on good tracing paper (not tracing cloth or vellum) and to mount this tracing in the following manner: Prepare a board, well cleated on the back and smoothly planed on its surface, of a size in length and breadth a little larger than the tracing. Give this surface a coat of white shellac varnish, which will be found to dry in a few minutes. Then laying the tracing with the drawing lines downwards on a smooth table or board, give a similar coat of varnish, and immediately after transfer the tracing to the prepared board. This has to be carefully done, as the varnished tracing must be kept extended by the four corners and laid down just where it is to remain. It will present a very uneven surface at first, but a gentle rubbing over with a cloth in the form of a round pad, beginning at the center and stroking to the edges, will remove the air from under it, and as the varnish dries and contraction takes place, the tracing will present a uniform smooth appearance, and the drawing will look as if drawn on the board. Another coat of varnish applied over the drawing, when the tracing is fixed and dry, will prevent the lines from being washed out or removed. It is then ready for the workshop, and can be carried about and used without damage. When a drawing is to remain in a workshop for several weeks or months, the delineation can be made on a smooth, well planed, squared board, which, after being sand-papered and washed over with a thin sizing of glue and water, will take pencil and ink lines, and pencil shading, like paper. When the drawing is completed, a coat of white or ordinary shellac may be applied. The latter plan is much used in English machine shops, and answers the purpose in an admirable manner.

The preparation of construction drawings always involves more or less expense, requiring, as they do, time, study in design, and attention to accuracy. Therefore, when completed and deemed ready for permanent use, their preservation becomes of great importance, and it is poor economy to allow such drawings to get soiled, greasy, and mutilated, a practice, however, too prevalent in many of our machine works and manufactories.

A Good Idea for House Numbering.

An excellent method of affixing the street numbers on houses has lately been introduced in Paris, the object being to render the numbers plainly visible by night as well as by day. On the front of the building is placed a small three-cornered lantern, one side resting against the wall and the angle projecting outwards. This is made of blue glass, with the number in white, the blue flashing being simply cut away in the usual manner by graving tool, acid, or sand blast. A gas burner serves as the means of illumination. In this city, especially in the up-town streets, some system similar to this is very much needed, as numbers when painted on fanlights become invisible when there is no illumination in the hall, making it a matter of no small difficulty to find a given address late at night, more especially when intervening empty lots break up the regular sequence of the numbers. Four hundred and fifty public buildings in Paris have already been numbered in this way.

WORK on the St. Gothard tunnel is progressing favorably. On October 14 last the distance completed was 5·6 miles.

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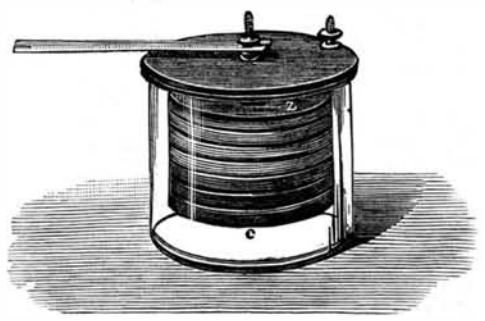
M. TROUVE'S NEW MOIST BATTERY.

M. Trouvé's new galvanic battery is a Daniell cell, which has the advantage of working without liquid, or at least without free liquid, capable of escaping from the cup. Each element, as shown in Fig. 1, consists of a circular disk of zinc, Z, and a disk of copper, C. These are placed parallel and separated by a number of paper disks somewhat smaller in diameter. This mass of paper is capable of absorbing considerable water and hence of remaining moist for a long time. The lower half of the layer of paper disks is soaked in a saturated solution of sulphate of copper, the upper half in a solution of sulphate of zinc. It will be seen that all the elements of a Daniell cell are present, and that the two liquids remain separated better than they would be by porous vases. The sulphate of copper becomes used scarcely any except during the passage of the current, and there is almost no work expended in the battery itself—a constant fault in the ordinary Daniell battery. The copper disk is

Fig. 1.



held in the center by a rod, insulated from the paper and zinc disks, which extends up through the slate cover. The latter fits hermetically over the glass vessel and thus evaporation is prevented. *Les Mondes* states that this battery remains constant for a year, needing no attention whatever. To renew it, it is sufficient to resoak the lower part of the paper in sulphate of copper. The sulphate of zinc being constantly formed by the action of the battery never needs replenishing. When the zinc is used up, a new disk is inserted, and it is best then to put in new paper. The copper, if freed from the pulverulent deposit of the same metal due to the current, lasts indefinitely. The electromotor force is is the same as that of the Daniell element. The resistance varies with the diameter of the metal disks and with the thickness of the paper layers. M. Trouvé has made many applications of this battery, notably to medical apparatus and to the purposes of military telegraphy. In Fig. 2 is represented its disposition in the latter instance. The battery is composed of three hard rubber boxes, superposed, and each containing three elements. This has sufficient power to work a sounder over several miles. It may be carried upside down or in any position.

HARRISON'S NEW PORTABLE FLOURING MILL.

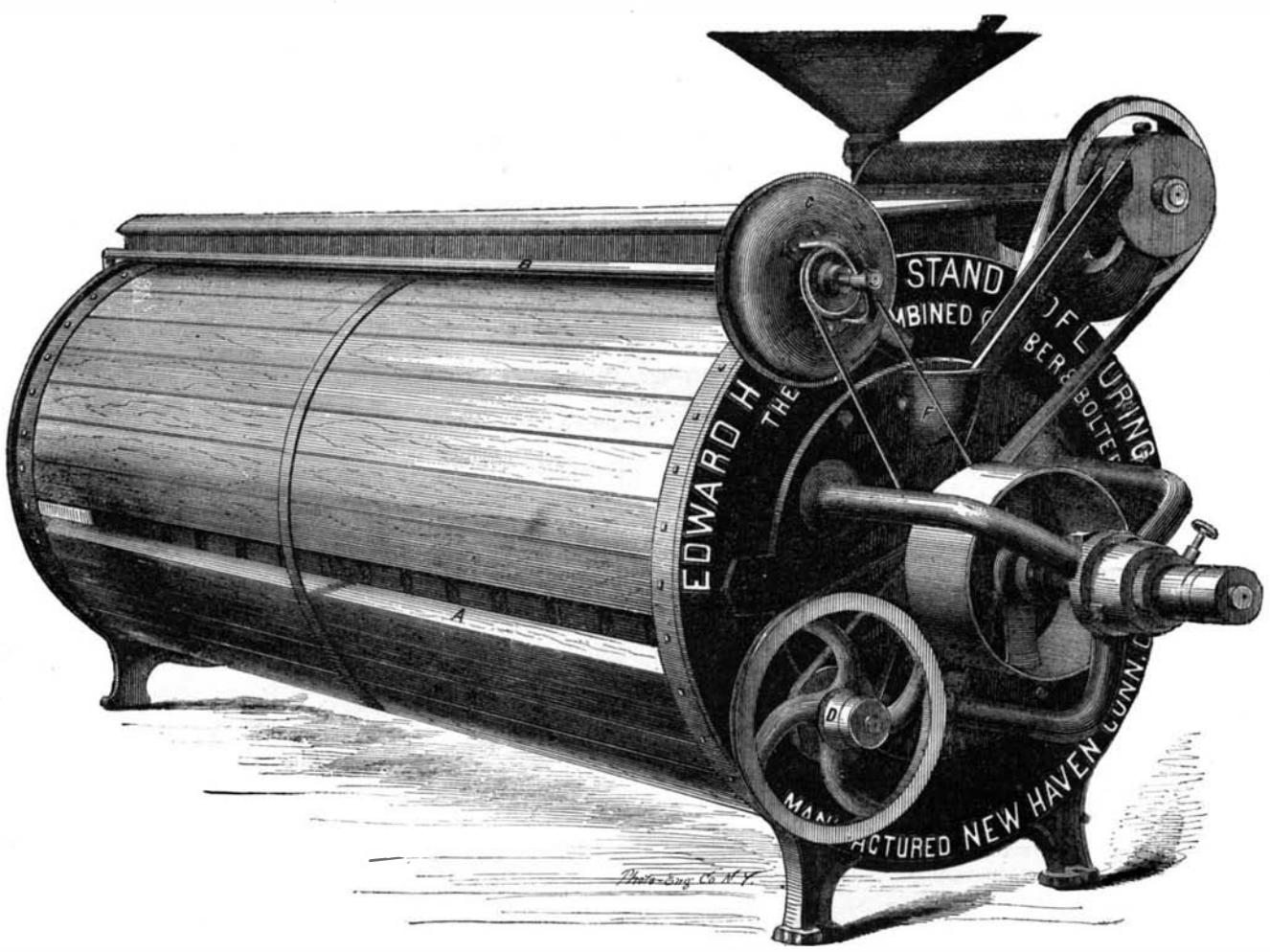
The annexed engraving represents a portable flouring mill manufactured by Mr. Edward Harrison, of New Haven, Conn., in which is combined all the necessary machinery for making flour, namely, grain scourer, grinder, and bolter. Its dimensions are, length 10 feet, diameter 3 feet, size of burrs 20 inches; capacity claimed about a barrel an hour, and weight 1,200 lbs. It is divided into three parts for shipment, the heaviest weighing about 500 lbs.

The bolter or mill case is made in cylindrical form, of wooden staves held together by cast iron heads, into one of which its grinder is fitted, and the scouring machine connected to it. The middlings and bran discharges are fixed in the head of the bolt reel at the opposite end, the bolting cloth being fastened to the reel, which runs the entire length of the mill.

The grinding machinery is supplied with all the improvements peculiar to Mr. Harrison's mills, which we have described in previous articles, including vertical burr and rigid runners, which have the effect, the manufacturer states, of cool grinders. Mills for grinding corn have long been used successfully by farmers and others not skilled in the art of milling, while the manufacture of flour has been done mainly by the large millers, and those running so called custom mills, furnished as a rule with horizontal grinders, by which means Mr. Harrison considers, that heated and damaged flour is produced.

Relative to the present machine, Mr. Harrison shows many testimonials to the effect that the best flour is made in paying quantities, that it received the highest consideration and award at the Centennial Exposition, that its use is being extended all over the world, and that it possesses superior advantages. Its construction is so simple that it does not require a scientific miller to superintend it, and its parts are not likely to become broken because of inexperience in operating it. It includes the necessary process of scouring the wheat before it is ground, which operation removes nearly half a pound of dirt from every bushel of wheat, and affords the means whereby every farmer can have his choice wheat made into flour without the necessity of going long distances to mill.

For further information address the manufacturer, Mr. Edward Harrison, 135 Howard avenue, New Hoven, Conn.



HARRISON'S NEW PORTABLE FLOURING MILL.

Lighting Cities by Electricity.

In the City of Providence, R. I., 220 street lamps, within a district over nine miles in length, are now lighted and extinguished in less than fifteen seconds by electricity, and the system is controlled by one man. After a trial of several months the practicability of the plan is assured, and if the whole of the 2,500 lamps in the city were lighted in this way, it is estimated that a net saving in expenditure for gas and labor would amount to about $25,000 per annum.

An "Industrial Wood Yard."

Last year some philanthropic individuals in Boston, desirous of helping able-bodied unemployed men by giving them work, opened a woodyard for preparing kindling and stove wood. This plan directly and indirectly was the means for relieving the suffering of some two hundred and fifty persons, who were willing to work rather than to tramp and beg. The results proved so satisfactory that this method will be put in operation during the ensuing winter.

An Aromatic Pipe that Colors in Thirty Seconds.

There will be two opinions as to whether M. Gisclon, in removing some of the troubles of pipe smoking, has or has not done a philanthropic work. If his invention tends to promote pipe smoking he has not; but if we consider that people will smoke despite all the preaching to the contrary that can be done, M. Gisclon deserves credit for obviating some of the expense, much of the annoyance, and possibly some of the dangers of the tobacco pipe. He soaks a pipe of common porous clay, worth a few cents, in a mixture of ether and alcohol, to which a little rose essence is added and in which is dissolved 10 per cent (by weight) of camphor, and 10 per cent of borax or other flux. With this is combined a trace of nitrate of silver. In this preparation, as above stated, the pipe may be soaked or the compound can be applied with a brush over the parts which it is desired to color. The advantages of this treatment, M. Gisclon savs, are that the pipe is made to look like meerschaum and to have a fine gloss; the smoke perfumed by the rose and camphor is agreeably aromatic, the pipe is cheap, and it will color nicely either by smoking or by exposing it to the light; in the latter instance thirty seconds' exposure is stated to be quite sufficient.

The Congo River.

Mr. W. Milner Roberts calls our attention to several references to the size of the Congo, made in Stanley's report and quoted by us, which he finds it difficult to reconcile. They are these: "It certainly exceeds the Nile in volume, and possibly also in area of drainage." "Where Livingstone was stopped, the Lualaba was a noble stream from 2,000 to 6,000 yards wide." That is one mile to three miles

Fig. 2

wide. "Near the equator, it developes into a still broader stream from two to ten miles wide, choked with islands."

"Then [referring to the Congo] at the cataracts, where the river breaks through the Coast Mountains, the stream narrows to 500 yards or less; then spreads out into a broad stream from two to four miles wide, with a current flowing about three miles an hour. The volume of water discharged is enormous; Captain Tuckey's estimate—2,000,000 cubic feet a minute—is probably not far from the truth." "At its mouth the Congo is a thousand feet deep." "The tide is felt as far as the first cataract, 40 miles up the river."

The quantity assigned for the discharge—2,000,000 cubic feet per minute—in a river two to four miles wide, flowing about three miles an hour (for a width of say three miles) would require a depth of less than six inches. So that either the width and rate of flow must be largely overestimated, or the quantity of water assumed must be very much too little. The flow of the Nile is at least ten times greater than the above, and the flow of the Mississippi must be thirty times greater than 2,000,000 cubic feet per minute.

Now if the Congo were a thousand feet deep at its mouth, with the width above mentioned (three miles) it is obvious that the current could be only about two thousandths of a mile per hour to correspond with the depth further up of only six inches, as the calculation shows; which would be nearly still water. In that case the other phenomena mentioned could hardly occur. The sea would not be freshened forty miles out.

A stream only 100 yards wide and 26 feet deep would, at the rate of three miles an hour, flow a little more than 2,000,000 cubic feet per minute. The Mississippi, just above the head of the passes, with a greater depth, is thirty times wider than that, being nine thousand feet across; and where it is narrowed to three thousand feet it has a depth of a hundred feet or more.

More accurate information than we now have in connection with the Congo river is desirable; and if the details of Stanley's observations do not afford something more definite, the next explorer of the river at the coast should be requested to make more careful notes. It would be interesting to know what the actual discharge of the Congo is—both in its high and low stages.

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Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

A late issue of the New York *Tribune* published what purported to be a synopsis of the Annual Report of the Commissioners of Patents, for the year ending October 1, 1877, containing a number of figures as to the amount of business done by the Office during the "business year," which might possibly have been true if the Commissioner had written any such report, which he had not, and will not do until after the close of the year ending December 31. I propose to wait until a report is written before sending a synopsis of it, leaving this style of enterprise to your fast neighbors of the daily press.

During the past week 379 applications for patents were filed, and 224 cases allowed. The receipts of the Office amounted to $12,501.

The trade mark treaty with Great Britain, which the cable reports has been signed by Lord Derby and Mr. Pierrepoint, will probably bring a large accession of business to the Office, as hitherto English merchants and manufacturers could not register trade marks here.

PATENT LAW AMENDMENTS.

The Patent Office Bar Association have agreed to present to the Congressional committees on patents certain amendments to the statutes, which they desire to have passed for the more harmonious working of our patent system, which amendments are said to have the approval of the Commissioner of Patents, and are mainly as follows:

Patents to be issued on the day of their date, not later than the second week after the final fee has been paid; and until the day of issue the Commissioner to have jurisdiction over the application, but no patent to be withheld from issue because of interference with any application filed subsequent to the payment of the final fee. Re-issue applications may be made and specifications sworn to by the owner or owners of the entire interests. The section requiring forfeited applications to be renewed within two years (if at all) to be struck out. All assignments, licenses, powers of attorney to sell or license, to be recorded within two months. The selling of interests in patents not vested in the vender to be punished by imprisonment or fine. Patented articles to be marked "Patented," with the year and number of the patent. The right to file caveats not to be limited to citizens. After the final decision in an interference suit the successful party is not to be put into another interference with any application filed subsequent to the closing of the testimony of the successful party; but after the patent is issued an interference may be had with said patent. Interferences to be appealable to the Supreme Court of the District of Columbia. The re-issue section to be changed, as shown by italics in the following:

SEC. 4,916. Whenever any patent is inoperative or invalid, by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more *or less* than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent and the payment of duty required by law, cause a new patent for *such invention as was shown in the model or drawings, or described in the original specification or its amendments, and might have been claimed in the original patent,* and in accordance with the corrected specification, to be issued to the patentee, or, in the case of his death or of an assignment of the whole or any undivided part of the original patent, then to his executors, administrators, or assigns, for the unexpired part of the term of the original patent. Such surrender shall take effect upon the issue of the amended patent. The Commissioner may, in his discretion, cause several patents to be issued for distinct and separate parts of the *things shown or described in the patent,* upon demand of the applicant, and upon payment of the required fee for a re-issue for each of such re-issued letters patent. The specifications and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. *In the case of re-issues no interference shall be declared with any patent of later date than that sought to be re-issued, except when the original application for such subsequent patent is shown by the Office records to have been of prior date to the application of the patent sought to be re-issued; nor with any application for a patent filed subsequent to the date of the patent sought to be re-issued; but if desired by such subsequent applicant or patentee on an application for re-issue, an interference may be had with the re-issued patent, after the same shall have been issued.* Every patent so re-issued, together with the corrected specification, shall have the same effect and operation in law, on the trial of all actions for causes thereafter arising, as if the same had been originally filed in such corrected form; but no new matter shall be introduced into the specification, nor in case of a machine shall the *specification be amended except by the model or drawings.*

Since the fire the Commissioner has paid great attention to the preservation of the burnt models in order to save, as much as possible, all that could be of use in reproducing them; and a recent examination shows that many thousands of them are almost as good as ever for the uses for which they were designed, although not quite as pretty to look at It is proposed to clean up, identify, and label all that can be of any use.

THE FRENCH EXPOSITION IN CONGRESS.

Notwithstanding the published reports that American citizens desiring to participate in the Universal Exposition in Paris can do so upon simple presentation by our Minister in Paris, the French Minister again informs our Government that foreign exhibitors cannot be admitted to the Exhibition except through the intervention of a special delegate officially designated by their Government and accredited to the French Commissioner General. In view of this it would appear that nothing will be done until Congress shall act in the matter, which will probably be soon, as a bill has been introduced by Mr. Hewitt, of your city, for this purpose, which authorizes the President to appoint a commissioner general to represent the United States, and appropriates $150,000 to pay expenses, of which not more than $50,000 are to be expended for salaries. The bill also requests the Governors of the different States to invite their people to assist in the proper representation of their handiwork and to take such further steps as they may think necessary to secure to their respective States the advantages to be derived from their exhibits.

Among the avalanche of new bills just introduced into Congress is one offered by Mr. Hunter, of Indiana, authorizing an expedition to the arctic seas. This is essentially the same bill as the one reported favorably by the Naval Committee of the last session, and embodies what is known as the Howgate plan. Another bill proposes to establish a department of commerce under a commissioner with a salary of $3,000 per annum, who shall be charged with the supervision of the commercial, manufacturing, and shipping interests of the United States, so far as they may be confided to the general Government. A third bill, introduced by Mr. Wallace, provides for the coinage of $400,000,000 in value of a coin metal, patented by W. K. Hubbell, of Pennsylvania, called "goloid," consisting of one part of gold, twenty-four parts of silver, and three fourths of a part of copper.

All the divisions of the

HAYDEN GEOGRAPHICAL SURVEY

have returned to this city from their explorations of the western wilds, and have begun the work of reducing their examination to the form of a report for official transmittal to the Interior Department and Congress. About 25,000 square miles were covered by primary triangulation by Mr. A. D. Wilson, who established 26 stations, upon which monuments were built, besides locating a great number of other points by foresight intersections, upon which the parties carrying on the secondary triangulation have built monuments. The division in charge of Mr. Henry Garnett surveyed about 12,500 square miles and erected 104 monuments. The division directed by Mr. Beckler surveyed about 6,000 square miles and built 40 monuments. As soon as the office work of the survey will admit, a chart will be prepared showing the location of all the monuments in relation to the public lands suitable for available purposes.

OCEAN EXPLORATIONS.

The coast survey schooner Palinurus has just returned from making a series of scientific observations in regard to the density of the water and character of the bottom of the Chesapeake Bay, with the special object of determining the quality of the water and the kind of bottom in which oysters reach the greatest perfection. Specimens from the bottom of the bay were obtained at 148 stations between Havre de Grace and points fifteen miles outside the capes, which are to be turned over to the chemical department of the coast survey for analysis, just as soils are subjected to similar processes by the Agricultural Department for the benefit of agriculture.

A NEW NIGHT SIGNAL.

The Bureau of Navigation will soon put in use on board our navy the new "Very Night Signal," invented by Lieutenant Very of the navy. By this plan of signalling, colored fire stars are projected from 200 to 300 feet into the air by a pistol, so that a commander in-chief may readily communicate with all his fleet in a crowded harbor, by a series of signals which may be seen and read by officers of all his vessels, notwithstand the space between them may be crowded with other craft. By firing a single red or green stars, or a combination of them, all the sentences in the navy code may be communicated. The stars burn with brilliant red and green lights, and can be seen at a distance of from ten to twelve miles.

The Spanish, Portuguese, and Dutch navies have signified their intention to co-operate with the Chief Signal Officer in extending his system of international meteorological reports, and the Portuguese Minister of War has ordered that these observations be taken during the Government exploration of Helonga, in Central Africa.

General Benet, Chief of the Ordnance Bureau, in his annual report states that, owing to the failure of the army appropriation bill for the present fiscal year necessitates the closing of the National Armory and the discharge of the operatives employed there, cutting off the supply of small arms, so that on the 1st of October the reserve was only 8,552 rifles and 5,983 carbines, and asks that an appropriation be made sufficient to manufacture at least 50,000 during the coming year. The General also recommends the passage of the Senate bill of the last Congress, giving the Court of Claims jurisdiction of claims for damages for infringements of patents. Under the law as it now stands, officers using patented articles are liable in their private means, while a refusal to use them under the orders of their superiors would render them liable to court martial.

FIREPROOF PUBLIC BUILDINGS.

An estimate is to be submitted to Congress for an appropriation to erect a new fireproof observatory, as the commission for examining the Government buildings have reported that the old one is so old and so much worn as not to be capable of being remodeled into a fireproof structure. The importance of making immediate provision for the safety of the valuable books and instruments can at once be seen when it is considered that many of the books and papers could never be replaced, and that the glass of the great telescope, although so large, is so clear that if a hundred of the same kind should be cast not one of them might be as good as this one, so that there would be great difficulty in replacing it if destroyed.

The building commission recommends that the Printing and Engraving Bureau be removed from the Treasury to a separate fireproof building to be erected for that purpose, to prevent the danger of destroying the records of the Treasury from the inflammable material constantly used in that bureau. This can be readily done out of the savings during the current year effected by the efficient head of this branch of the Treasury Department, as there has been saved out of the appropriation for it during the first three months of the fiscal year no less than $150,000, and it is believed that the aggregate saving for the current fiscal year will not be below $600,000. Besides this saving the work to be done by the bureau upon internal revenue stamps will cost about $120,000 less than was paid for the same work last year.

THE COTTON CROP.

The cotton report of the Department of Agriculture for October makes the average condition nearly as high as in 1876. It is 81·1 this year against 82·7 last year, and 88 the year before. The decline in condition during September was less this year than last. In portions of Texas and Arkansas heavy rains prevailed in the early part of that month, and from the 16th to the 20th a violent storm swept through the cotton belt, doing great damage by beating out the fibre and rotting the bolls. A loss of at least 20,000 bales is reported from the overflow of the Black Warrior and Tombigbee in in Alabama. The caterpillar has done less damage than was feared, the most serious losses from this cause being in Texas and Louisiana. In the more northern States of the cotton belt they will accomplish quite as much benefit as injury by reducing redundant growth of foliage and hastening maturity of fruitage.

Accounts received here from all parts of the United States show that the wheat crop this year is the largest that has ever been produced in this country.

COMMERCIAL STATISTICS.

From the report of the Chief of the Bureau of Statistics, it appears that the total commerce of the United States for nine months, ending September 30, was $796,000,000, in merchandise, showing an increase of $58,000,000 over the corresponding period of 1876. The movement of specie in the nine months of this year amounted to $60,000,000 or $2,000,000 more than last year. The balance of trade still remains largely in our favor, it being $53,000,000 in our favor during the nine months, although it does not equal our balance for the corresponding period of last year, when it was $77,700,000. About five eighths of this enormous foreign trade appears to have been transacted through New York. It is estimated that the yield of gold and silver for the current fiscal year in the States of California and Nevada will be as follows: Nevada—Comstock lode, $20,000,000 silver, $17,000,000 gold; balance of the State, $6,000,000 silver, $1,000,000 gold. California—$15,000,000 gold, $1,000,000 silver. Total, $60,000,000.

Washington, D. C. OCCASIONAL.

Repairing the Washington Monument.

To the Editor of the Scientific American:

It is reported by the engineering board which has recently examined the foundation and soil underlying it of the Washington monument, that it is built on a compressed clay that has now to sustain a weight of five tons to the square foot and that the completed structure will exert a pressure of seven tons to the square foot. The only way to make the structure stable is to increase the area of its base—excavations in clay are dangerous at the best, as they expand as well as contract, and when it is already under a great pressure, it is very difficult to handle. I propose the following method of increasing the bearing surface, which can be done without risk.

First: A ditch is dug entirely around the foundation and at a proper distance from it. This ditch is to be filled with beton of high tensile strength, and is so to be constructed as to form a monolith.

From this circumscribing wall tunnels are run in to the base of the foundation and under it. These tunnels are narrow and are to be filled with beton as fast as the excavation is made. You have then something in the shape of a wheel, the felloes and tire being the circumscribing wall, the ribs the spokes, and the monument being the hub. By putting an invert between the ribs, the new foundation becomes a a saucer.

Beton is the proper material for this purpose, as you can obtain a monolith and get a greater benefit from the circumscribing wall as well as fill completely all excavations. By this process of removing the earth and stone and replacing it section by section, the area of the base can be enlarged without risk, the new foundation forming part with the old one.

Brooklyn, N. Y. JOHN C. GOODRIDGE, JR.

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PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXXIX.

GEARING.

The term gearing is generally understood as meaning toothed wheels, which are said to be in gear, or geared together, when the teeth of one engage with those of another. The expression "a gear" always implies a toothed wheel. The term gearing, however, is frequently applied in connection with other qualifying words to distinctive parts of an engine or machine, as valve gear, slide gear, reversing gear, but in neither of these cases is it to be understood that those mechanical parts contain any toothed wheels or indeed wheels of any description. Wheels which communicate motion one to the other by simple contact of their surfaces are turned friction wheels, or friction gearing. Thus in Fig. 234 let A and B be two wheels that touch each other

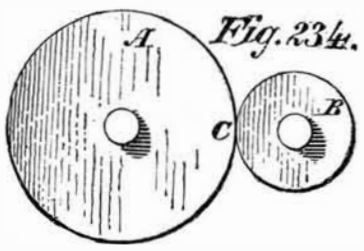

Fig. 234.

at C, each being suspended upon a central shaft; then if either be made to revolve, it will cause the other to revolve also, by the unassisted adhesion of the surfaces meeting at C. The degree of force which will be thus conveyed from one to the other will depend upon the character of the surface and the length of the line of contact at C; if the material is very hard and the surface highly polished, the force transmitted would be quite inconsiderable, but would be largely increased if the surfaces revolving against each other were of a rough character, as in the latter case the minute projections causing the roughness would act upon each other.

In this class of gearing great strain is put upon the bearings; and as the latter wear, the frictional contact becomes diminished, and the usefulness of the device soon becomes impaired. To obviate this defect, and to further increase

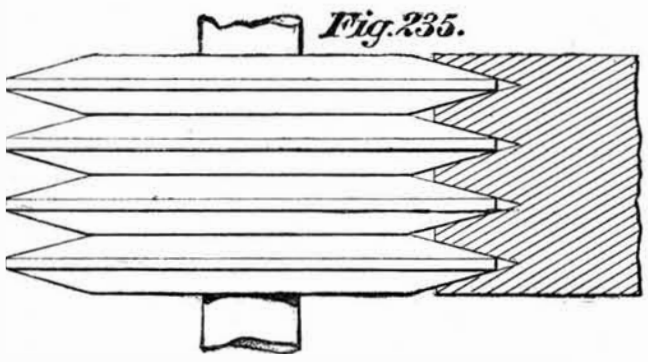
Fig. 235.

the power transmitted, the line of contact is increased by what is known as the "wedge and groove frictional gearing" which is shown in Figs. 235 and 236. In this case, not only

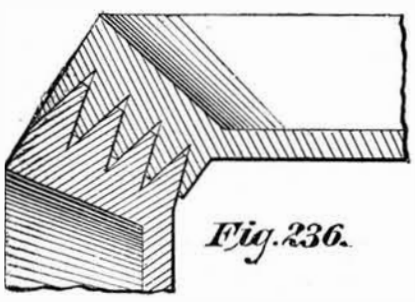
Fig. 236.

is the line of surface contact increased, but the strain due to the contact is so placed as to, in a great measure, counteract itself. Let us, for example, consider the strain placed upon one groove as shown in Fig. 237. The surface pressure on

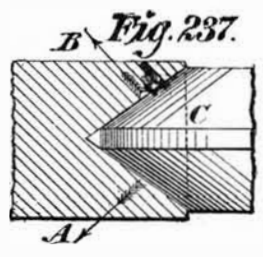

Fig. 237.

each side will be at a right angle to the face, or in the direction described by the arrows. A and B, one being in exactly opposite direction to the other. The surface contact acts to thrust the bearings apart. The line of surface acting to thrust the bearings apart being denoted by the dotted line, *c*. The relative efficiency of this class of wheel, however, is not to be measured by the length of the line, *c*, as compared to that of the two contacting sides of the groove, because it is increased from the wedge shape of the groove, and furthermore, no matter how solid the wheels may be, there will be some elasticity which will operate to increase the driving power due to the contact. It is to preserve the wedge principle that the wedges are made flat at the top, so that they shall not bottom in the grooves even after considerable wear has taken place. The object of employing this class of gear is to avoid noise and jar and to ensure a uniform motion. The motion at the line of contact of such wheels is not a rolling, but, in part, a sliding one, which may readily be perceived from a consideration of the following. The circumference of the top of each wedge is greater than that of the bottom, and, in the case of the groove, the circumference of the top is greater than that of the bottom; and since the top or largest circumference of one contacts with the smallest circumference of the other, it follows that the difference between the two represents the amount of sliding motion that occurs in each revolution. Suppose, for example, we take two of such wheels 10 inches in diameter, having wedges and grooves ¼ inch high and deep respectively; then the top of the groove will travel 31·416 inches in a revolution, and it will contact with the bottom of the wedge which travels (on account of its lesser diameter) 29·845 inches per revolution.

A spur wheel is one which has the breadth of the teeth parallel to the shaft axis, as in Fig. 239. The dotted line denotes the breadth referred to, and A represents the axis. A bevel wheel is one which has its teeth at an angle with the axis, as in Fig. 240. A crown or face wheel is one having its teeth at a right angle to its axis, as in Fig. 241. A miter wheel is one having its teeth at an angle of 45° to its axis. as in Fig. 242. An annular or internal wheel is one having its teeth convergent to its center. The roots of the teeth being at the largest diameameter. Spur wheels act upon each other in the same plane. Bevel wheels act upon each other at an angle.

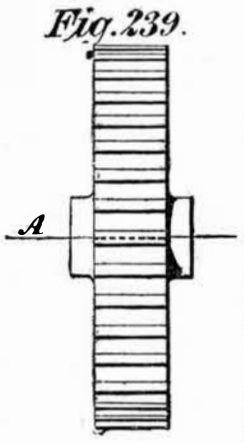

Fig. 239.

When the tooth of a wheel is made of different material from that of the teeth of the wheel with which it gears, it is termed a cog, but if in a pinion it is sometimes termed a leaf, while in a trundle it is termed a stave. A wheel which impels another is termed the driver or leader. The wheel impelled is termed the driven wheel or follower. A series of wheels geared together is termed a train. When two wheels are geared together the larger is termed the wheel, and the lesser the pinion. When a wheel is formed of a continuous web instead of having arms, it is termed a plate wheel.

The length of a tooth is the distance from its base to its extremity. The breadth of a tooth is the distance it extends across or upon the face of the wheel. The pitch line of the wheel is the circle upon which the pitch is measured, and it is the circumference by which the diameter or velocity of the wheel is measured. The pitch of a wheel is the distance of one tooth from the other, measured on the arc of the pitch circle, or pitch line, as it is usually called. The line of centers is the line between the centers of two wheels The radius of a wheel is the semi diameter, extending to the periphery, but in referring to the radius of a wheel, the pitch line is always, in practice, referred to. The radius is understood to be the distance from the center to the pitch line of the wheel.

The teeth of a wheel should be as small and as numerous as is consistent with the required strength. It is desirable that the number of teeth in a wheel should be prime to the number of the pinion, that is, the number of teeth in the wheel should not be divisible by the number in the pinion without leaving a remainder. This is advisable in order to prevent the same teeth coming together so often as to cause an irregular wear to the teeth. For this purpose an odd tooth is often introduced into a wheel, which is termed a hunting tooth. As an illustration of the desirability above referred to, suppose a pair of gear wheels are employed to drive a machine in which, as in the case of shearing machines for cutting plate iron, the duty is very severe, but lasts during, say, for example, one twentieth of the revolution of the gear wheel. If then the same teeth are always in gear or contact at the time the heavy duty is being performed, those teeth will rapidly wear away, because they sustain continuously this heavy duty, whereas by the employment of a hunting tooth, or by a prime number of teeth in the wheel, the heavy duty will be distributed over the various teeth. If, however, the revolutions of one wheel must be divisible without any remainder by the revolutions of the other, the number of teeth also must be so divisible.

We may now proceed to consider the principles that are to guide us in giving to the teeth of wheels their correct form or outline, so that the wheels when moved by them shall at as uniform a velocity as they would by the simple contact of their circumference. It is conceded by all authorities that there are an infinite number of forms of teeth which will enable one wheel to communicate equable motion to another, and it can be shown, say Willis and others, that within certain limitations, if any form of tooth be given, another may be determined which will work correctly with it. In actual machine practice the epicycloidal and involute curves have been universally adopted for wheel teeth on account of the facility and accuracy with which they may be mechanically described, and perhaps because they admit

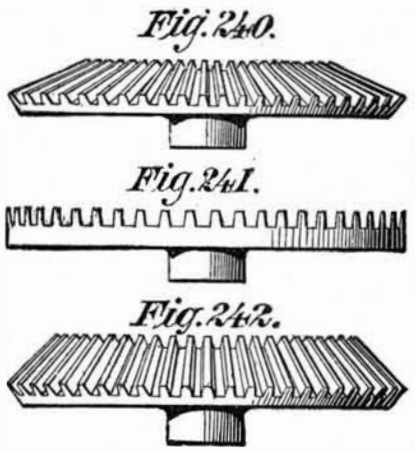
Fig. 240.

Fig. 241.

Fig. 242.

of ready and independent demonstration of their possessing the properties required for their duty.

Why Milk Sours during Thunderstorms.

BY MALVERN W. ILES, PH. D.

There have been various surmises in regard to this subject; none, so far as we have been able to learn, have been substantiated by experiments.

In order to see if milk did really sour during heavy thunderstorms, I made several observations which proved to me that this was not an erroneous opinion which is so commonly held by the dairymen. My experiments to arrive at the cause of the phenomena thus observed may be stated as follows:

I took skimmed morning's milk, filled a eudiometer tube (300 c.c.), then introduced 100 c.c. pure oxygen gas.

Then by the use of an ordinary battery, and a small Ruhmkoff coil, caused sparks of electricity to pass through the oxygen for five minutes. The current was then broken, the tube shaken up and allowed to stand for five minutes. The milk does not appear quite as opaque, and shows a noticeable acid reaction.

On continuing the current for five minutes longer, making in all 10 minutes, the milk curdles very perceptibly, and shows a decided acid reaction.

The contents of the tube on standing for twenty minutes had reached the consistency of ordinary sour milk or bonny-clabber.

From the above experiments it will be seen that the oxygen was converted into ozone, which we think may be stated as the cause for the rapid souring of milk during thunderstorms.

The increased acidity is due to the formation of lactic acid, and most probably some acetic acid, by means of the ozone. One or both these acids, then, causes the casein to be precipitated.

Submarine Explosions.

An interesting paper by Lieut. Andic, on the effects of submarine explosions, appears in the *Revue Maritime et Coloniale* for September. He concludes *inter alia* that gun cotton can develop in water pressures twenty times greater than a charge of powder of the same weight. It may be likened, for rupture of hulls, to 3·75 times its weight of powder. The measurement of the wheat-sheaf jets of water leads to no plausible result in investigation of the sphere of action. Apart from the advantage of its less volume, and its harmless character in handling, gun cotton is less advantageous than 3·75 times its weight for charging fixed torpedoes. Powder may be used at much greater depths than those which have been fixed as limits. Beyond certain depths, it takes considerable charges to obtain at the surface a sphere of action of 7·50m. An immersed torpedo of 2,000 kilogr. of powder, 40m. from the bottom, is capable of making a hole 6 meters in diameter in a ship above it. There is a considerable difference between the lateral and the vertical effects of a torpedo, and in England attention is directed mainly to utilizing the vertical effect, by uniting torpedoes in groups to be fired simultaneously.—*English Mechanic.*

Submarine Cable Statistics.

Of submarine cables, private parties own 149; miles of cable 59,547; miles of wire 65,535. Governments own 420 cables; 4,442 miles of cable and 5,725 miles of wire. Norway has 193 cables, Sweden 4, Denmark 29, Holland 18, Russia 3, Germany 46, Turkey and Greece 13, Italy 12, Spain 6, France 26, and Great Britain 52. The Anglo-American company has the longest submarine cable in the world, 2,585½ nautical miles, and has five Atlantic cables in all, besides twelve other cables, a total length of 12,315 miles. The Eastern Telegraph Company has 48 cables, with 21,883 nautical miles.

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A New Autographic Process.

In the Belgian *Bulletin du Musée*, M. Hannot describes the following new autographic process. The writing or drawing is made upon any kind of paper, which should, however, not be very thick. A special ink is used, composed of gum arabic or gelatine ⅜ ozs., water saturated with bichromate of potash 1 quart, and sufficient Indian ink to color the whole. The gum is first dissolved in the solution and the ink afterwards added. The preparation must be kept sheltered from the light, and when used a portion should be poured out in an inkstand of black glass. When the drawing is finished it is exposed to light, whereby the lines are rendered insoluble.

A plate of zinc or a stone is then prepared and polished with emery, and the drawing is placed upon it face downward. Above the latter is laid a sheet of paper covered with gum arabic, and above this two or three sheets of dampened blotting paper. The whole is then pressed. The moisture in the blotting paper reaches the gummed paper, and the gum, dissolved, traverses the autographic paper and affects the zinc or stone everywhere except where the insoluble lines of the design have prevented its passage. A roller of greasy ink may then be passed over the plate, and the grease will adhere only to the lines which are not covered with moisture. Printing is then done in the usual way.

Phosphorescence of Quinine.

If some sulphate of quinine is strewn over a sheet of smooth paper and exposed to a heat of from 120° to 140° Fahr., by means of a plate of metal, it becomes phosphorescent when stirred with a glass rod. Valerate of quinine exhibits the same phenomenon without heat being applied, if the crystals are rubbed in a mortar. It is said that the appearance is only noticed when the valerate contains an acid prepared directly from the root of valerian.

IMPROVED BORING MACHINE.

Machinery of some sort for boring is almost indispensable in all wood-working establishments, and some of the contrivances in every-day use for that purpose are no longer economical in view of the improvements now made in this as well as the other branches of wood-working machinery.

The boring machine illustrated herewith is one of several sizes and styles built by Walker Brothers, Philadelphia, and is a heavy and substantial, yet easy working machine, designed for straight and angle boring of all kinds, the spindle carrying bits up to 2 or more inches in diameter, and having a capacity for boring to the depth of 12 inches.

The frame or standard is a coned casting in one piece, having a broad base, and is quite firm and rigid throughout. The work remains stationary upon the table, which may be adjusted to the proper height or angle, and the bit is brought down and fed through by the foot of the operator on the lever or treadle below. This treadle is provided with a stop to regulate the depth of cut, and with the upward stop the travel of the spindle may be regulated for thick or thin stuff.

The spindle is balanced by means of the adjustable weight on the lever above, and will return when the pressure of the foot is removed. The table is provided with two adjustments for angle boring, and a gage that may be removed when not in use, the whole being raised and lowered by simply turning the hand wheel underneath.

The proper range of speed is given for large or small bits by means of cone pulleys, and the countershaft may be set so as to run the belt from any direction and not interfere with parts of the machine.

This boring machine is furnished when desired with a full set of auger bits, including a small universal chuck for holding all kinds of straight shank bits or drills. For further information address the manufacturers, Messrs. Walker Brothers, Nos. 73 and 75 Laurel St., Philadelphia, Pa.

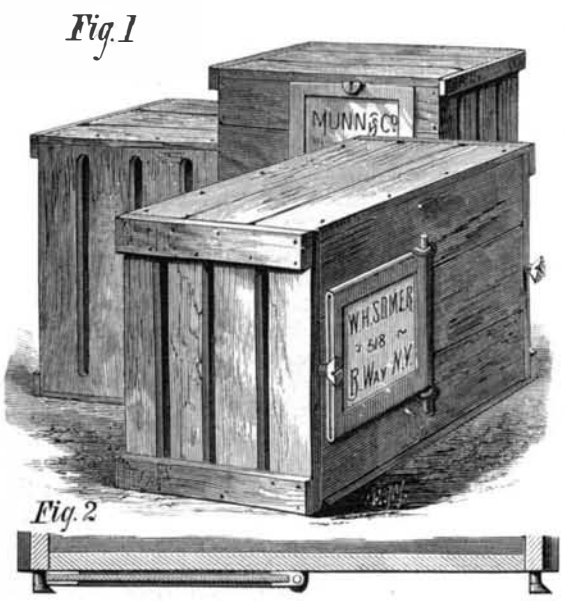
Preparation of Celluloid.

Paper is treated by a continuous process with 5 parts of sulphuric acid and 2 of nitric acid, which converts it into a sort of gun cotton. The excess of acid is removed by pressure, followed up by washing with abundance of water. The paste when thus washed, drained, and partially dried, is ground in a mill, mixed with camphor, ground again, strongly pressed, dried under a hydraulic press between leaves of blotting paper, cut, bruised, laminated, and compressed again in a special apparatus suitably heated. It is said to be hard, tough, transparent, fusible, becoming plastic and malleable at 125°. It ignites with difficulty, is decomposed suddenly at 140° without inflammation, and gives rise to reddish fumes. It is inodorous, and does not become electric on friction.—*English Mechanic.*

IMPROVED LABEL HOLDER.

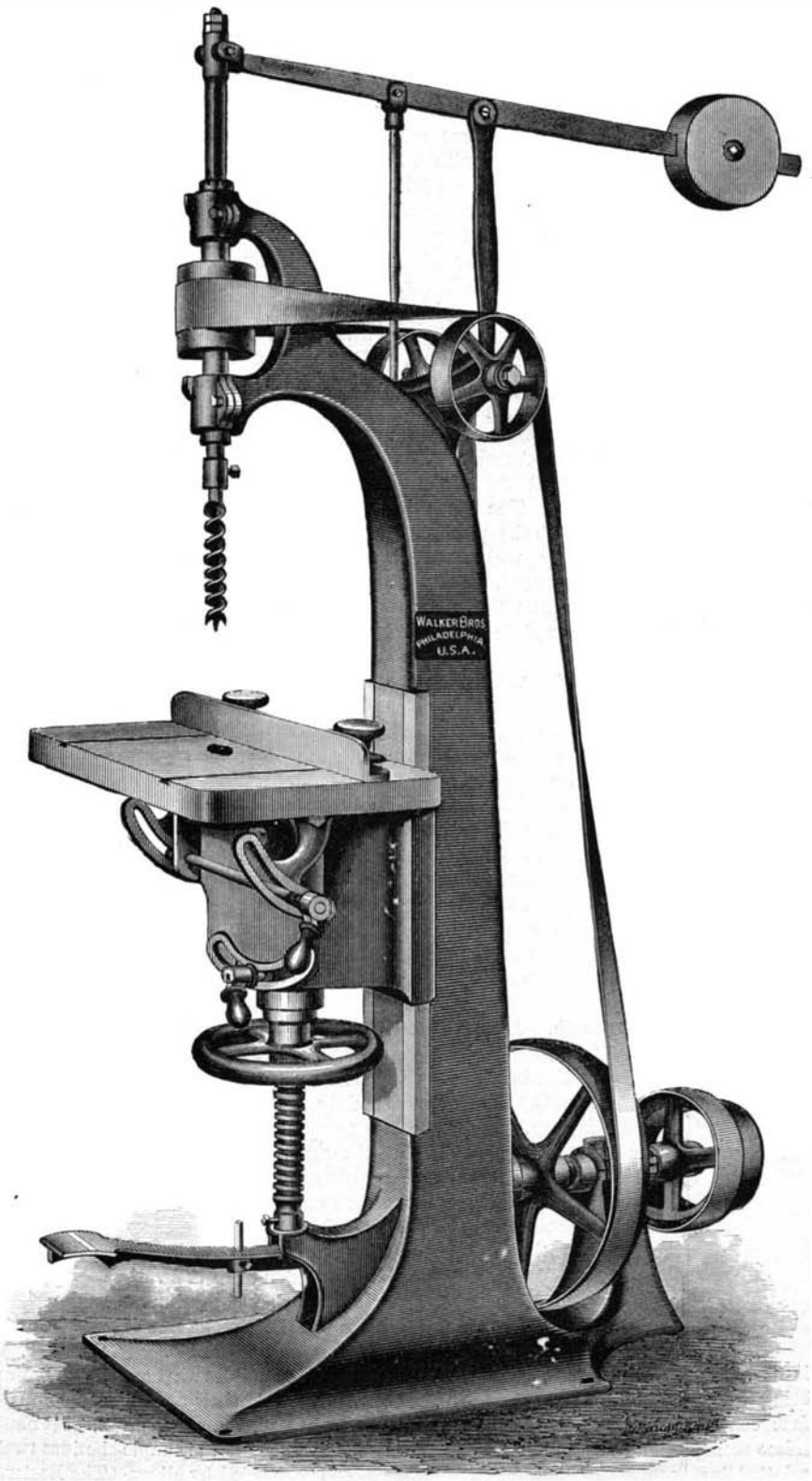
The invention herewith illustrated is particularly intended for use in sending butter, eggs, fruit, or other articles by return package or crate.

Attached to the box or crate is the card holder, A, made of sheet metal or other suitable material, in the shape of an



open frame, the frame being grooved in such a manner that a card may be slipped into it from the outer end.

At the inner end of the holder are pins projecting at top and bottom; or a wire may be fastened in the inner end of the frame, and its ends project to form such pins. These pins are held to the box or crate by means of staples driven into the same over said pins, thus hinging the card holder to the box in such a manner that the holder may be turned with either side outward, and it is held by means of half-headed screws or hooks. The card of any house to which the box or crate is to be shipped may be inserted in the holder, and on the obverse side of the card the return address is written. All the consignee has to do when he desires to return the package is to turn the screw or hook on one side, reverse the holder, and fasten it by the screw or hook on the other side. For further information, address W. H. Somers & Co., Hume, Alleghany County, N. Y.



WALKER BROS.' VERTICAL BORING MACHINE.

Dr. Isidor Walz.

Isidor Walz, Ph.D., died in New York city on October 25. He was born in Bavaria May 5, 1846. He emigrated to the United States in 1859, and graduated at Columbia College in 1864. He studied chemistry under Bunsen and Erlenmeyer at Heidelberg, and received the degree of Ph.D. in 1867. He practiced his profession in this city, and in 1870 became editor of the *Manufacturers' Review and Industrial Record.* He conducted this paper with marked ability until October, 1876, when his declining health caused him to undertake a trip to Europe. Last month on his homeward journey he contracted the disease, pneumonia, which terminated his life.

Recent Investigations on Hydrophobia.

Hydrophobia has of late been extraordinarily prevalent in in London. Hardly a day passes, says the *Lancet,* without some fresh cases being recorded, and the attention of the medical profession has been closely directed to the nature of this most terrible disease. The data thus far gathered are valuable, not so much as establishing new facts, but in corroborating and shedding more light on some which have hitherto received little notice. From the conclusions now reached it appears that a sharp distinction is drawn between mental hydrophobia and the genuine disease. An adult, when bitten by a dog supposed to be rabid, passes through a period of intense mental perturbation, suffering all the agonies of doubt, apprehension, and foreboding. These mental disturbances induce symptoms closely resembling those of the genuine disease. The manifestations of hydrophobia in man are perversions of the nervous centers, and disturbances of the reflex center and highest psychical organs. The former is tolerably uniform, the latter extremely variable. In one case reported by the *Lancet,* there was little mental disturbance, very slight wandering at the close, and none of the wild paroxysmal furor which is commonly so conspicuous and so terrible a feature of the disease. In another case the psychical disturbance was so predominant that the patient was taken to an asylum as a simple lunatic.

The symptoms of true rabies are not always alike. Its approach may generally be detected by some alteration in the manner and habit of the tainted animal. In some, which are naturally bright and lively, unusual dullness, whilst in others, which are of the opposite disposition, unnatural vivacity are occasionally the premonitory symptoms. There is a remarkable variation in the period of incubation. The disease may be latent in the system for as long as three years. This accounts for the outbreak of the disease in apparently healthy dogs. The popular idea that a person once bitten has a peculiar liability of developing the disease at intervals of seven years after the occurrence is sheer nonsense. Three years seems to be the longest period of incubation known.

The "respiratory spasm" is a conspicuous feature in every case. It is compared by one to the "hurried or intermitting gasping one sees in a child attempting to drink when sudden thirst has been induced by recent violent exertion," and by another to the inspiratory spasms witnessed "when a cold shower-bath is administered to an individual." It is excited not only by an attempt to drink liquids, but also by mental impression, and the sight of water, or sound of running water, will bring it on.

Underground Telegraphs.

Between Berlin and Halle an underground telegraph wire has been in use for one year, and underground wires are about to be laid between Berlin and the cities of Cologne, Frankfort, Strasbourg, Breslau, Hamburg, Kiel, and Königsberg, thereby dispensing with posts and insulators, and avoiding the cost of their maintenance. The copper wires which convey the electric current are enclosed in wrought iron pipes, and are hermetically enclosed by insulating material, which protects them from the action of air and water, and prevents oxidation.

A CHEAP vinegar consists of 25 gallons of warm rain water with 4 gallons of molasses and 1 gallon of yeast. The mixture can be used after it has been allowed to ferment.

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Coloring Zinc Roofs.

Among recent German inventions is a simple process, depending on the use of acetate of lead, by which every kind of color is applicable to sheets of zinc. By mixing black-lead, for instance, with the salt, a very agreeable light brown hue is obtained. It is by this proccss that the cupola of the synagogue at Nuremberg has been painted. A sufficient length of time has already elapsed, it is said, to show that the atmosphere had no influence on the zinc sheeting of the roof, thus showing the practical value of the process in such cases. By the addition of other coloring matters light or dark shades of yellow or gray may be produced.—*English Mechanic.*

THE NEW FRENCH EXPOSITION PALACE.

The annexed engravings afford an excellent idea of the magnificent palace which has been erected in Paris for the Exposition of 1878. The palace stands on the summit of the hill, and its terraces look down not only on the Exhibition and the Champ de Mars opposite, but over the greater part of the city. The palace extends along the whole width of the Trocadéro, nearly 1,300 feet. It consists of a grand Central Hall, the axis of which coincides with that of the Exhibition, and of two wings, which, spreading east and west from the vestibule behind the hall, extend in a curve for a distance of 650 feet on each side. It contains one large theater of a horseshoe form, measuring 164 feet in one direction and 230 feet in the other. It will accommodate 7,000 persons, and will be fitted up with private boxes and the various tiers of seats necessary for public accommodation. The main entrance will not be from the Trocadéro grounds, but from the other side on the Place du Trocadéro. The entrance will consist of a large vestibule wider than the hall itself, and extending on both sides into spacious antechambers, which enclose the hall itself, as far as the stage in the latter. These chambers lead into the two wings before spoken of, and the axes of which intersect the back of the hall just to the rear of the stage, while the tower which terminates each wing stands forward 285 feet from that axis, so that the hall is thrown comparatively far back, partly subdued by the extended and advanced wings, but by reason of its great height and striking architectural features the most prominent characteristic of the palace. The wings contain a covered gallery 42 feet wide, and in front an open promenade about 18 feet wide, the roof of which is carried by elaborately carved stone columns. Similar terraces or colonnades surround the Central Hall on its Trocadéro front, and rise tier above tier to the upper gallery of the building. The two wings terminate in vestibules, thrown forward as already stated, and reached from the Trocadéro by flights of steps, for the difference between the ground level where the vestibules are placed, and the floor of the palace, is about 26 feet. The wings form approximately a semi ellipse, each being struck from four different radii. It is intended that this structure shall remain as a permanent monument of the Exhibition of 1878. We are indebted to *Engineering* for the engravings.

A CURIOUS RESULT OF DENUDATION.

In a paper on the volcanoes of the Haute Loire and the Ardêche, in the *Popular Science Review*, Rev. W. S. Symonds refers to an isolated rock, some 30 feet high, of twisted basaltic columns resting on granite which he found in the villages of Antraiques. This rock, an engraving of which is

herewith given, is a most remarkable monument of denuding powers of atmospheric influences: as it is evident that the basalt had flowed into a fissure in the granite, and that the granite walls have since been denuded. It is rarely that a mork striking example of the rapid changes which are being made on the earth's surface by the slow action of atmospheric causes has been presented. The red color of the planet Mars has been ascribed to this same agency, it being suggested that red sandstone has resisted the denudation better than other geological formations, and hence gives its color to the general planetary surface. The rock represented in our illustration is locally known as the "Pain de Fromage," or "Cheese Loaf."

New Telemeters.

According to an Austrian paper, two new systems of telemeters have recently come into use in German coast batteries. They are based, like all others, on the principle of measuring a base line and of angles at the base, in order to determine, with the aid of tables, the height of the triangle. Without giving details of construction, it is simply stated that the two observers communicate their results obtained at either extremity by electricity, and they are also in electric communication with the place where the commander of the battery is. In the one instrument, that of Garlt, the electricity merely communicates by telegraphic signs the angles obtained. In the other, constructed by Siemens and Halske, the electric current transmits automatically, by an instrument situated at one point, the angle measured by the altitude at the other. But the latter, though made with great precision, is liable to grave errors, and though much more rapid than that of Garlt, is less liked.—*English Mechanic.*

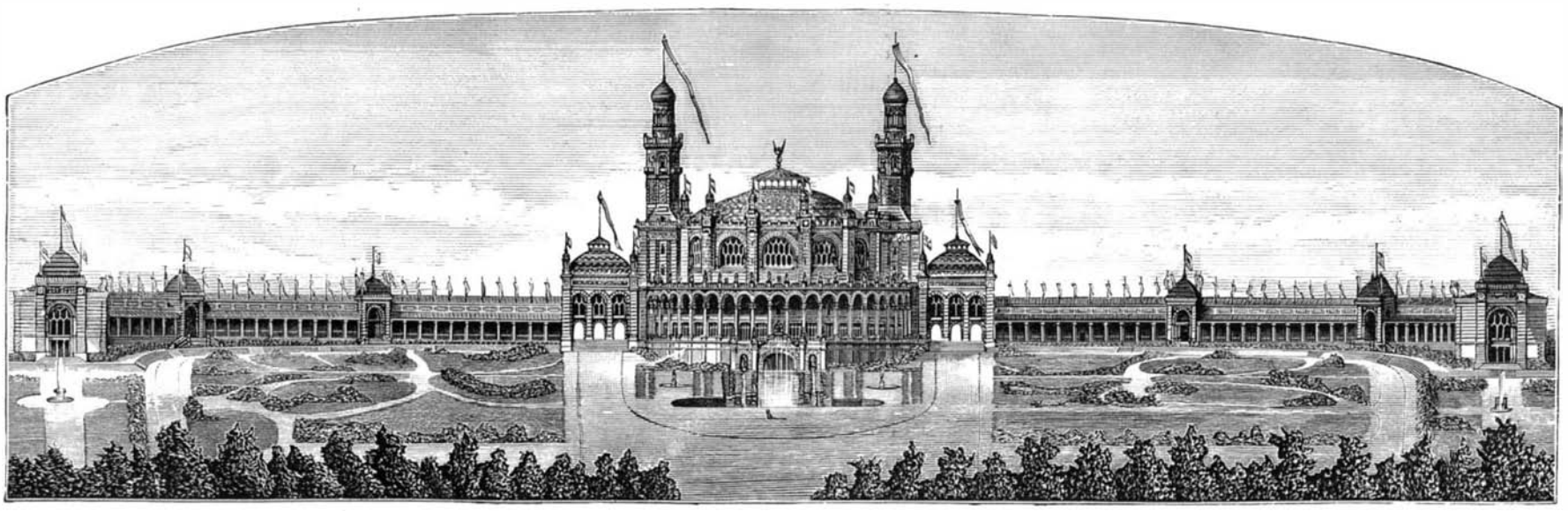
Medical Harmony.

A late number of the *Lancet* contains an article on the healing of difference between the old allopathic and new homeopathic schools, which is significant of a great change in medical opinion and the possible future fusion of the two schools. After briefly reviewing the origin of the homeopathic schism, and the subsequent warfare, the writer, Dr. Richardson, F.R.S., says that many of the allopathic physicians have renounced all the heresies of the past in the treatment of acute diseases; while homeopathic physicians have, on their side, almost entirely abandoned the use of globules, and have substituted doses in tangible form, their rule being to give a dose sufficiently large to effect its purpose, but not so large as to discomfort the patient. Both schools now use alike anodynes, aperients, opiates, anesthetics, tonics, galvanism, hydropathy, Turkish bath, and mineral waters. In short, he says, we define our practice as rational medicine, including the application of the law of contraries, but *plus* the application of the law of similars.

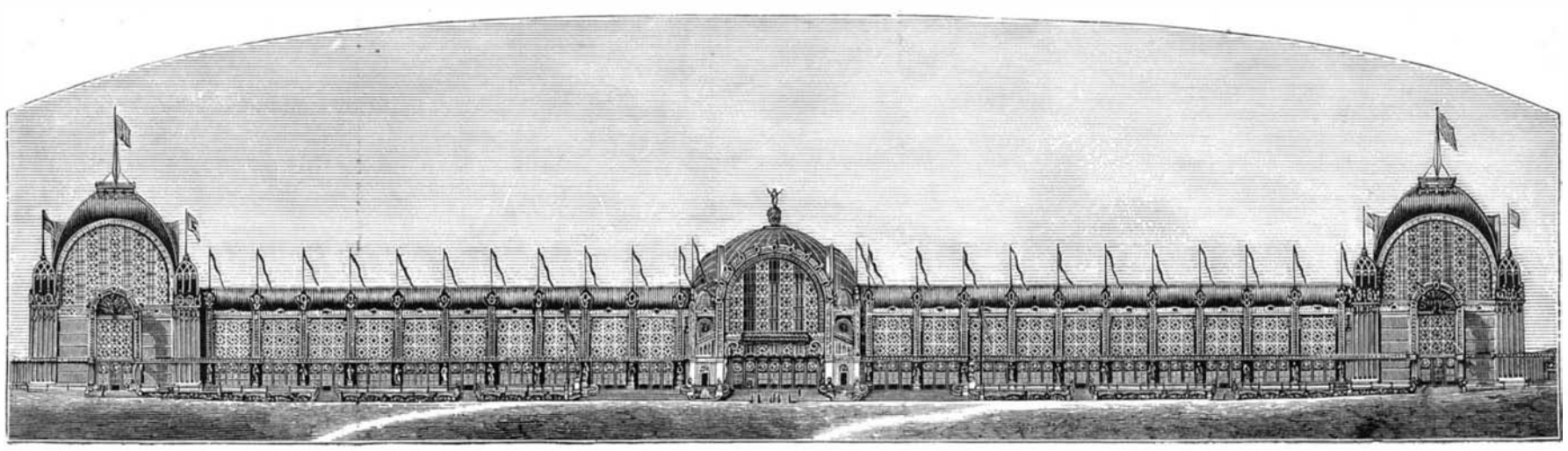
Parisian Copying Ink.

The best kinds of copying inks are, as is well known, prepared by adding a percentage of alum, sugar, and glycerin, or salt, to the extract of logwood. Such inks have a violet tint, and gradually become blacker on paper. The copy is, however, very pale at first, and is often indistinct. The Parisian copying ink is distinguished from the common kinds by its appearance more or less yellow in a liquid state, and by producing a distinct bluish-black on paper. It has the additional advantage of preserving its fluidity, while the common kinds soon thicken. Professor Gintl recommends the following method of preparing an ink which has all the advantages of the Parisian: A strong solution of logwood extract is treated with 1 per cent of alum, and then with as much lime water, so that a permanent precipitate is formed. Some drops of weak chloride of lime are then added, so that a perceptible bluish-black color is attained, and hydrochloric acid is added by drops till a red solution is obtained. A little gum is then added, with 0·5 per cent of glycerin.—*English Mechanic.*

In Yucatan and Honduras musk is extracted from alligators. Their fat is used for oil, and their skin for shoe leather.



THE FRENCH EXPOSITION BUILDING FOR 1878.



THE FRENCH EXPOSITION BUILDING FOR 1878.

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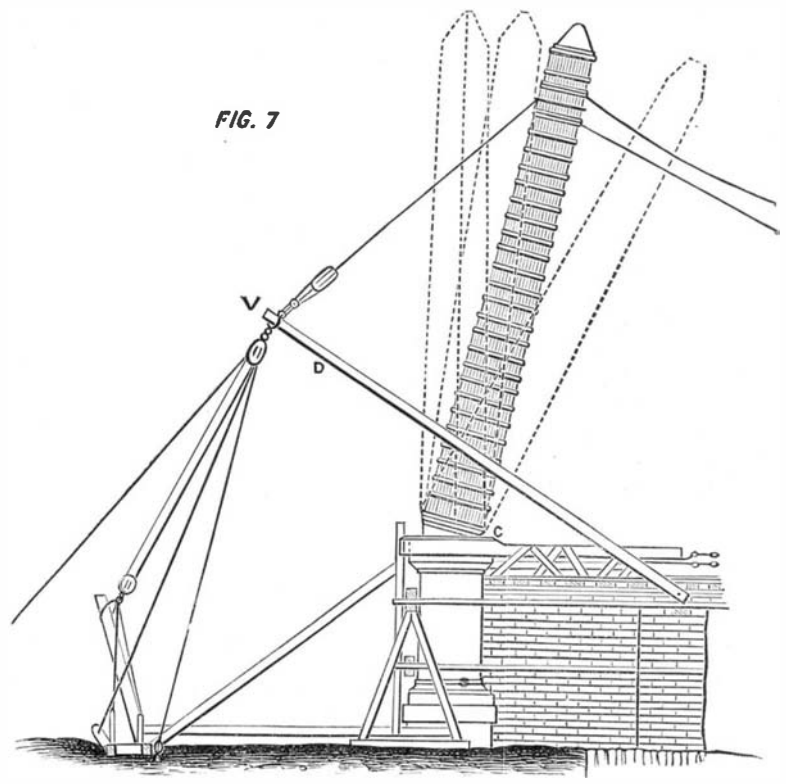
RAISING OBELISKS.

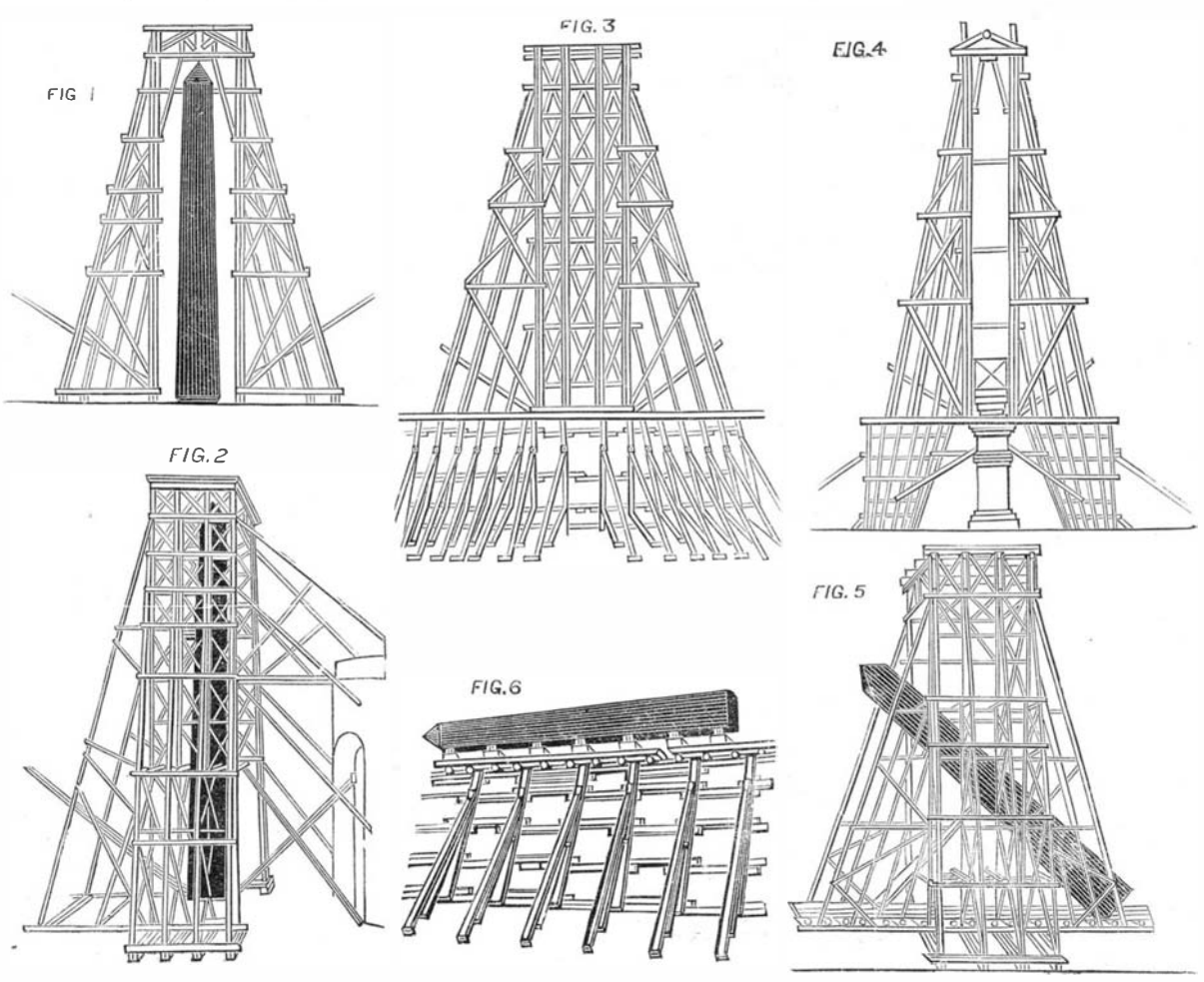
Now that New York is to possess an obelisk, it will soon become a question among engineers as to the best means of transporting and erecting the great mass of stone after it is landed at our docks. The most instructive examples of this class of work with which we are acquainted are supplied by the raising of the great obelisk in front of St. Peter's at Rome, by Domenico Fontana, and the putting in place of the Luxor obelisk in Paris. Both operations are thus described by Cresy:

The St. Peter's monolith was estimated to weigh 993,537 lbs.; the height is 180 palms, but without the apex, 77·2 English feet; the transverse section at the middle contains an area of 7·6 superficial feet; the solid content may, therefore, be taken at upwards of 166 cubic yards, weighing about 332 tons; if to this be added 4 tons for the weight of the apex, the whole weight of the obelisk raised is upwards of 336 tons. The length of each of the sides at bottom is 12½ palms, and at top 8½ palms, the palm being equal to 2·7 English inches. Forty-six cranes, 600 men, and 140 horses were employed in removing it, and the timber, ropes, and iron made use of cost 20,000 crowns. The operations for removing it, which were conducted with the greatest skill, were as follows: A scaffold, called a castellum or shears, Fig. 1, was first constructed, 7 feet higher than the top of the obelisk when mounted on the pedestal. The eight principal timbers, four on each side, were 89 feet in height from the foundation; they were each built of oak and walnut, four beams in thickness, and banded at every 9 feet with strong iron hoops, and bolted together in several parts. The whole was so arranged that it could be easily put up or taken down, to suit the several positions in which the obelisks might be placed. Where this castellum was to be used, four holes 3 feet square were prepared in a platform of travertine stone, into which the four posts were dropped or secured. The obelisk was cased over with double mats to protect it from injury; was then covered with 2 inch planks, and longitudinal iron bars, 4 inches in breadth, were attached to it, three on each of the four sides: these, connected together by nine iron hoops, served to attach the tackle. This coating of mat, wood, and iron was estimated to weigh as much as one twelfth of the obelisk. Thus entirely covered the obelisk was lifted from the pedestal on which it stood by means of capstans and blocks attached to the iron hoops, and the blocks hanging to the cross beams of the shears; after it was lifted up 2 feet perpendicularly, a platform of timber was introduced beneath it, which rested on wooden rollers 9 inches in diameter, their ends being secured by iron hoops. The ropes of the blocks attached to the four lower angles of the obelisk being drawn, the platform which supported the weight moved on the rollers, and the ropes of the blocks attached to the upper part of the obelisk being slackened, the obelisk gradually descended, and was laid horizontally on the platform prepared to receive it; during its descent it was found necessary to support it in the middle by two shores, Fig. 5, made movable on an axis attached to its center, and which prevented any very great strain on the tackle. The inclined plane along which it was moved to its destination was formed of a mound of earth strengthened with timbers, and extended from the Circus of Caligula, afterwards called that of Nero, to the position where the obelisk now stands. Its former site is still marked by a stone in the passage leading from the sacristy to the choir of St. Peter's. After the obelisk had been moved along this plane upon wooden rollers, Fig. 6, the forty-six capstans placed round the mound of earth were prepared for their work of raising; they were fixed in the ground on each side, and each had four arms or handspikes; the first and third arms were worked by a horse, and the other two each by from six to ten men; four of the capstans acting upon as many blocks were used for drawing the foot of the obelisk forward, one block to each angle; the other capstans were employed to raise the obelisk into a vertical position. The whole operation is amply described in a work compiled by Fontana, and in which are engravings of the entire machinery. The foundations prepared to receive this enormous weight were carefully executed. An excavation 43 feet square, and to the depth of 24 feet, was made, and the bottom being found a clay, it was piled entirely over with oak and chestnut, with piles 18 feet in length and 9 inches in diameter, the bark being previously removed from them; upon these was laid a bed of concrete, composed of basalt broken into small fragments, and mortar composed of lime and puzzolana. The total cost of the entire removal was about $45,000. The arrangements are shown in the accompanying figures, 1, 2, 3, 4, 5, and 6, which we take from *The Engineer*.



RAISING OBELISKS.

M. Lebas, an engineer of the Marine in France, was commissioned in 1831 to bring from Luxor, in Egypt, one of the granite obelisks, and raise it on a pedestal to ornament the city of Paris. It is 75 feet in height, containing about 3,000 cubic feet, and was estimated to weigh nearly 258 tons. The obelisk was cased with timber throughout its entire length; underneath its base, at the lower side, was placed a wooden roll or cylinder, C, Fig. 7, upon which the whole obelisk turned as upon a hinge during its movement; there were five stays on each side, formed of masts, one of which is shown at D; these were all united at their summit between two others laid at right angles with them, the whole being bound round with ropes. The ten masts rested on a level platform, and their ends being rounded, they worked in a hollow channel prepared to receive them, and together could be moved upwards or downwards, in the manner of a hinge, so that, when the ends at E were pulled down by the ropes of the windlass attached to them, the obelisk was advanced further into its perpendicular position; 480 artillerymen worked ten capstans, forty-eight being placed to each. Iron chains were placed around the top, and four others passed to capstans at the extremity of the inclined plane, for the purpose of holding the obelisk steady, and rendering its motion regular as it advanced. The whole of the operations were admirably conducted, and some improvements were adopted which we do not find made use of by Fontana; the application of the lever, D, is a decived advantage.



RAISING OBELISKS.

The Cause of Putrefaction and Lactic Fermentation.

In delivering the recent inaugural address at King's College Medical School, Professor Lister adopted a novel course towards such an audience, and instead of occupying the time at his disposal with the usual recommendations to the students about to enter upon their medical curriculum, he preferred to treat of a special subject in the hope that he might be able to say something which should interest and possibly instruct his audience. The subject chosen by Professor Lister is one that has long been of deep interest to the cultivators of several branches of science, and his own efforts to make a practical application of the knowledge acquired by studying the phenomena of fermentation have given to that subject a wider significance than it had before.

The particular kinds of fermentation which were the subject matter of Professor Lister's address were those which take place in blood and in milk, the question to which his attention had been directed having regard to the cause of the change which takes place when either of these liquids is kept for some time in contact with the air. In the case of blood the fermentation which ensues under these conditions is of the kind termed putrefaction; in the case of milk it is characterized by the formation of lactic acid, and is consequently termed lactic fermentation. In the experiments by which Professor Lister sought to illustrate the nature of the changes which took place in these liquids, care was taken to collect both the blood and milk in such a manner as to exclude the access to them of living organisms. It is unnecessary here to enter upon a description of the precautions observed to attain this result, the important fact being that blood so collected had been kept for six weeks without undergoing putrefaction, and that the air in contact with it was quite sweet. From this observation Professor Lister inferred not only that blood has no inherent tendency to putrefy, but also that atmospheric oxygen is not capable of causing it to putrefy, as has been supposed. Some kind of action was exercised by the oxygen upon the blood, as was indicated by the change of color from that peculiar to venous blood to the crimson color of arterial blood, but it was not until the blood thus preserved had been touched with an extremely minute quantity of putrescent blood on the point of a needle that putrefaction commenced.

The result in this case was exactly parallel to that which takes place in alcoholic fermentation, and the inference is that putrefaction is in fact a kind of fermentation characterized, like the alcoholic fermentation, by the reproduction of the ferment by which the change is produced.

As is well known, there is a conflict of opinion on the point whether the bacteria, which are unquestionably constant concomitants of certain kinds of fermentation, are also the cause of the change or merely accidental. It was suggested by Professor Lister that one of the causes of doubt as to the influence of bacteria in causing fermentation is the extreme minuteness of the organisms.

With the object of investigating this question more fully, experiments were made with another form of fermentation, that

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of milk, which, on exposure to the air, turns sour and curdles; the sugar it contains being converted into lactic acid. At the same time microscopic observation always reveals the presence of minute organisms of the nature of bacteria in the coagulated milk. By collecting a number of samples of milk in separate glass vessels, with suitable precautions to prevent the access of organisms, the milk in a few of the glasses was found, after some weeks, to be entirely free from change, destitute of any acid reaction; and under the microscope, no indications of the presence of bacteria were to be found.

The next step in the investigation was to find evidence to decide whether the particular bacterium found in sour milk was or was not the cause of the lactic fermentation. For this purpose, Professor Lister endeavored to estimate the number of bacteria in a given quantity of sour milk, by placing one fiftieth of a minim of the milk on a slide, and counting the number of bacteria in the field; then by diluting the milk to such an extent that a single drop of the liquid would probably contain, on the average, one bacterium, a liquid was obtained, with which a number of separate quantities of boiled milk were inoculated, by adding a single drop of the liquid. The result was that out of five glasses of milk treated in this way only one was curdled, and on examination the one was found to contain the *bacterium lactis*, while the four others, which did not curdle, had no bacteria in them.

In another series of experiments, five specimens of milk were each inoculated with a drop of the liquid, calculated to contain two bacteria; other five specimens were inoculated with drops calculated to contain one bacterium; another set of five open glasses were inoculated with drops calculated to contain one bacterium; and one with a drop calculated to contain four bacteria. The result was that the last specimen curdled in a few days, and all those calculated to have two bacteria curdled in a few days. Of the five glasses calculated to have one bacterium, three remained liquid. On opening one of these glasses the milk was found to be perfectly sweet; it had a slight flavor of suet, similar to that which Pasteur has described as resulting from the oxidation of the oleaginous constituent of milk.

The result of these experiments proves conclusively that the ferment which caused the curdling of the milk was not in solution but in the state of suspended particles, otherwise every drop of the inoculating liquid should have produced the same result. Again, the fact that some drops were destitute of the ferment proves in like manner that it was not in solution.—*Pharmaceutical Journal.*

The Ancestry of Insects.

In his new work on "Our Common Insects," Mr. A. S. Packard gives an excellent chapter under the above caption. He considers that the natural system is the genealogy of organized forms; and when we can trace the latter we establish the former; and he concludes that there is a strong genetic bond uniting the worms, insects and crustacea in one grand sub kingdom. Many of the most interesting facts pointed out by Mr. Packard are presented in condensed form below.

The lowest form of insect life is the parasitic mite, the highest is the hive bee. Between these two there is an ascending scale of being, a continuity of improving organizations, which affords strong arguments for the theory of evolution. The mite is called the pentastoma, and lives in the manner of the tape worm a parasitic life in the higher animals. It is found in the nostrils of dogs, sheep, and horses. It is a little higher than some worms but lower than others. Young mites when hatched have but three pairs of feet, while their parents have four. If these early stages of mites and myropods are compared with these of the true six-footed insects as the cicada, or dragon fly, it will be seen quite plainly that they all share a common form. By simple modifications of parts here and there, by the addition of wings and other organs in these simple creatures, Nature has rung numberless changes on the elemental form. Starting from the simplest kinds, such as the poduras, spiders, grasshoppers, and May flies, allied creatures which we know were the first to appear in the earlier geologic ages, we rise to the highest, the bees with their complex forms, their diversified economy and wonderful instincts. In this progress upwards the beetles are higher than the bugs and grasshoppers, and the butterflies and moths more highly organized than the flies. In the egg nearly all insects agree most strikingly in their mode of growth. The earlier stages of the germ of a bee, fly or beetle bear a remarkable resemblance to each other, and suggest that a common design or pattern at first pervades all. At a certain period in the life of the embryo, we notice that all agree in having the head large, and bearing from two to four pairs of mouth organs resembling the legs; the thorax is merged with the abdomen and the general form of the embryo is ovate. The first to discuss the subject of the ancestry of insects was Fritz Muller, who suggested that the larva of crabs, zoëa, was the common ancestor. Haeckel and Friedriech Brauer have partially sustained this idea. The latter declared his belief that, though it seemed premature after the discovery of highly organized winged insects in rocks so ancient as the Devonian, to even guess as to the ancestry of insects, yet he would suggest that, instead of being derived from some zoëa, "the ancestors of insects must have been worm-like and aquatic." Mr. Packard rejects the zoëa origin of insects, and says the only refuge is in the worms. But how to account for the transmutation of any worm into a form like the leptus, with its mandibulated mouth and jointed legs, seems at first well nigh impossible. We have the faintest possible indication in the structure of some mites, and of the tardigrades and petastoma, where there is a striking recurrence to a worm-like form, readily noticeable. In the demodex we see a tendency of the mite to assume, under peculiar circumstances, an elongated, worm-like form. The mouth-parts are aborted, while the eight legs are not jointed and form simple tubercles. In the tardigrades, a long step lower, we have unjointed fleshy legs armed with from two to four claws, but the mouth-parts are essentially mite in character. A decided worm feature is the fact that they are hermaphrodites, each individual having ovaries and spermaries, as is the case with many worms. When we come to the singular creatures of which pentastoma and linguatula are the type, we have the most striking approximation to the worms in external form. They lose the rudimentary jointed limbs, which some have well marked in the embryo, and from being oval, rudely mite-like in form, they elongate, and only the claws remain to indicate the original presence of true jointed legs.

Professor Ganin, a Russian naturalist, made some remarkable discoveries in regard to the early stages of the platygaster, a parasite on a gall fly. He established facts which bear strongly on the theory of evolution by "acceleration and retardation." In the history of many early larval stages we see a remarkable acceleration in the growth of the embryo. A simple sac of unorganized cells, with a half-made intestine, so to speak, is hatched, and made to perform the duty of an ordinary, quite highly organized larva. Even the formation of the "primitive band," usually the first indication of the germ, is postponed to a comparatively late period in larval life. The different anatomical systems appear at longer or shorter intervals, while in one genus the respiratory organs are not developed at all. Thus some portions of the animal are accelerated in their development more than others, while others are retarded and in some species certain organs not developed at all.

That the cylindrical form of the bee grub and caterpillar is the result of modification through descent is evident in the caterpillar-like form of the immature caddis fly. In like manner the caterpillar form is probably the result of the leaf-eating life of a primitive larva, and the soft-bodied maggot of the weevil is evidently the result of its living habitually in cavities in nuts and fruits. So the organs of special sense in insects are in most cases simply altered hairs, which are themselves modified epithelial cells.

NEW ARRANGEMENT OF THE AIR RESERVOIRS IN PUMPS.

The object of the air reservoir in pumps and hydraulic machines is to equalize the movement of the water and to deaden shocks. Its action will be more efficacious in proportion as (1) the head of water is low; (2) the movement slow; (3) the section of pipe and valves large; (4) it is itself large, and (5) as the mass of water is small. Given the pressure and dimensions of the pump in order that the reservoir may operate to best advantage, it is further necessary that it contain as much air as possible, that the water pipes be completely isolated, and that it be disposed as near as possible to the point where shocks and other disorders are most likely to occur. We illustrate herewith a new arrangement of air reservoir which we extract from *Dingler's Journal.*

Fig. 1.

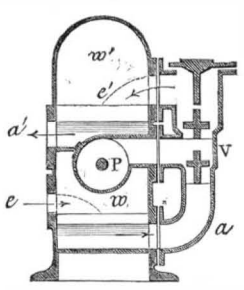
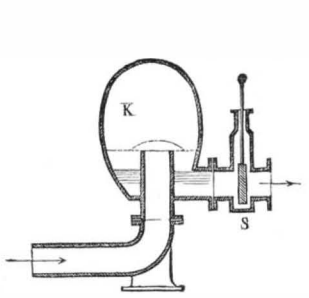


Fig. 2.



P is the section of the pump, V the valve box, *w* the reservoir of aspirated air, and *w'* that of compressed air. The dotted lines indicate the highest levels, full lines the minimum normal level. The entry pipes, *e e'*, are placed exactly above the maximum level, and escape pipes, *a a'*, are situated as low down as possible.

By this arrangement it is claimed that sudden shocks are impossible. Even if the valve, S, be opened suddenly, so as to allow of the escape of considerable water at once, the perturbation affects immediately only the small column of water comprised between the air reservoir and the escape orifice. The water in the tube remains as before, as it is only after the air pressure in the reservoir, K, is diminished that the flow progressively becomes more rapid.

The Melting Point.

The theory that iron in a cupola is melted all up through the stock is wrong, for every cupola has a certain point at which the iron is melted, and there is not a pound of iron melted in any cupola until it comes down to the melting point. The melting point in a cupola is generally from six to eighteen inches above the tuyeres, but it may be raised or lowered a little by increasing or diminishing the amount of fuel in the bed; but if we get the bed too high it throws the melting point too high, and the result will be slow melting. If we get the bed too low, it will allow the iron to get below the melting point, and the result will be dull iron; and in order to do good melting in any cupola, it is very essential that the melter should know the melting point of his particular cupola. The melting point of a cupola is at the point at which the most intense heat is created by the action of the blast upon the fuel. This intense heat at the melting point will cut the lining more than at any other place in the cupola, and the lining will generally be found to be cut out more just above the tuyeres than at any other point, which indicates the melting point of the cupola. If the tuyeres are put in so as to distribute the blast evenly through the stock, and the changes of iron and fuel are put in evenly, and every charge leveled up properly, the heat will be even all through the cupola, and the lining will be cut out in a regular belt at the melting point all around the cupola. On the other hand, if the tuyeres are not put in so as to distribute the blast evenly through the stock, or the charges of iron and fuel are not put in even and level, or if the fire is all on one side of the cupola, the heat will not be even through the cupola, and the lining will not be cut out in a regular belt at the melting point, but will be cut full of holes, which shows that the cupola is not melting all around, but is only melting in spots. By this irregular charging and melting in spots, the cupola may be reduced to half its melting capacity, which accounts for a cupola melting fast on one day and slow on another day. As before intimated, the melting point in a cupola is the point at which the most intense heat is created by the action of the blast upon the fuel. When the blast enters the cupola it is cold, and as it passes through the heated fuel it becomes hot, and as it becomes hot it creates heat by combination with the fuel, and makes an intense heat. If we have a very strong blast it will travel fast and will pass through the fuel rapidly, and it will have to pass through more fuel before it becomes heated sufficiently to make an intense heat by combination with the fuel. On the other hand, if we have a mild blast, the blast will pass through the heated fuel slowly, and is more heated, so that it does not have to pass through so much fuel before it becomes sufficiently heated to make an intense heat by combination with the fuel; so that when we have a strong blast the melting point of a cupola is higher than when we have a mild or weak blast; and the bed has to be put in higher in a cupola with a high melting point than in a cupola with a low melting point, which accounts for one cupola requiring more fuel in the bed than another cupola does. When the cupola is in blast, the bed or fuel in the bottom of the cupola is constantly burning up, and the unmelted iron will get down below the melting point. To prevent this, the melter has recourse to charges of fuel between the charges of iron, and as the charges of iron are melted and drawn out at the tap hole, the charges of fuel come down and replenish the bed and again raise the melting point; the next charge of iron comes down and is melted and drawn out; the bed is reduced and is again replenished by the next charge of fuel, and so on through the whole heat. If we supply too much or too little fuel between the charges of iron, the melting point will be raised too high or reduced too low, or in other words, if we have a melting point of ten or twelve inches in height in our cupola, and we supply twenty or twenty-five inches of fuel, this extra fuel must all be burned up before the iron can come down to the melting point; and we will not have a continuous melting, but will have a delay between each charge of iron. If, on the other hand, we have only five or six inches of fuel between the charges of iron, when we should have ten or twelve inches, this small amount will not more than half replenish the bed, and the unmelted iron will get down too low and will not make hot iron, and the iron may not be melted at all; and in order to do either fast or economical melting, we must not use either too much or too little fuel, and we must have the fuel distributed so as to suit the particular cupola in which it is used; for, as before explained, there are scarcely two cupolas that will melt exactly alike on account of the melting point being higher or lower, which is caused by a stronger or weaker blast, or by more or less draft; and in order to do good melting, the melter should not charge his cupola just the same as some other cupola of the same size is charged because that cupola does good melting charged in that way; but he should vary the height of the bed and the amount of fuel between the charges of iron, and the amount of iron on the bed and on each charge of fuel, until he finds the exact proportions that will do the best melting in that particular cupola.

Melters, in changing from one cupola to another, will generally have trouble in making hot iron, and they will often make a complete failure of melting in a strange cupola. This is simply because they undertake to charge that cupola the same as some other cupola that they have been melting in, and they never pay any attention to the draft, blast, or the melting point of the cupola, which is the cause of their failure in melting in a strange cupola. When a melter takes charge of a strange cupola, his first object should be to study the draft of the cupola, the nature of the blast, and to ascertain the melting point of the cupola. He can generally tell where the melting point is by noticing where the lining is cut out the most, and he can tell whether the cupola is melting evenly, or is only melting in spots, by noticing whether the lining is cut out in a regular belt all around the cupola, or is only cut out in holes, as before explained. He can tell whether the bed is too high or too low by noticing how the cupola melts. He can tell whether he is using too much fuel between the charges of iron, or if he is putting in the charges of iron too heavy, by noticing whether the cupola melts regularly or not, and by noticing if it

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makes regular iron; for if the iron is very hot in one part of the heat and dull in another part, it is a sure indication that the fuel is not properly distributed through the iron, and it should be remedied by increasing or diminishing the weight of the charges of fuel or iron.

In melting with coke, the melter cannot put in his iron in as large charges as he can with coal, because the coke is more bulky than coal, and he has more bulk in the same weight, and if he puts the same weight of coke between the charges of iron as he does of coal, the bulk of the coke will raise the iron above the melting point, and the iron cannot be melted until part of the coke is burnt up so as to allow the iron to come down to the melting point, and the result is that he does not have a continuous melting, but he has a delay between each charge of iron, and the iron will probably be dull in the latter part of each charge; but the melter can do equally as regular melting, and can do faster melting with coke than he can with coal, by putting in the coke and iron in smaller charges, and more of them, which proves conclusively that good melting can be done with almost any fuel and in any cupola, if the melter understands his business; but he may not be able to do as economical melting in a poor cupola as he can in a good one.—*From Founding of Iron, by Edward Kirk.*

[For the Scientific American.]

HOW TO ADJUST ENGINE GUIDE BARS.

A correspondent says; "I am about putting new guide bars to my 16 horse power stationary engine, and desire instructions how to adjust them true with the bore of the cylinder, that the wrist pin will stand in the same line with the driving shaft." He adds: "The bars are bolted to the cylinder cover at one end and to pedestals at the other." Drill holes in the ends, leaving about $\frac{1}{32}$ inch to ream out after the bars are set and in their place. Screw the bottom bars temporarily in their places beneath the crosshead. The gland should be screwed up well into the stuffing box; the piston rod, crosshead, and guide bars cleaned and the rod oiled to cause it to move freely. Then take a spirit level and try if the driving or main shaft of the engine stands horizontal; if not it is as well to true it up with pieces of the requisite thickness inserted under the journal box which requires lifting to make the shaft stand level. If the bottom half of the box has flanges upon it so that the packing piece or liner cannot slip out, it will be retained by being simply laid in position, otherwise it may be required to be pinned or riveted to the bottom of the box. If, however, it is decided not to adjust the main shaft, the spirit level may be placed upon it and a slight mark made to denote where the center of the bubble stands. At the same time, note which end of the spirit level stands toward the engine crank. This being done, pass to the guide bars and move the piston in and out to ensure that it moves freely. If the cylinder cover is off, it will pay to take out the piston rings to facilitate setting the guides.

The next procedure is to place the piston in about the middle of the cylinder and bolt up one of the bottom bars until it just touches the face of the crosshead guide and stands at the same time true with the bore of the cylinder, as tested by the spirit level. The bore of the cylinder being level the bar must be set level, but if the bore stands out of level the bar must be set to correspond. The guide bar being thus adjusted to lightly touch the guide on the crosshead, the other bottom guide bar is adjusted in the same manner. The spirit level must be placed across the two bottom bars and the latter adjusted until the bubble stands in the same position as it did when placed upon the horizontal part of the engine shaft. This is necessary to ensure that the axial line of the wrist pin (which is of course supposed to stand true with the bottom faces of the crosshead guides) shall be adjusted to stand parallel with the axial line of the engine shaft, which is an important consideration because otherwise the connecting rod would be twisted when its brasses were keyed up. The next operation is to move the crosshead once or twice up and down, and if it binds unduly at either end the spirit level should be placed across the bars at that end and the bar or bars lowered, to maintain the same spirit level adjustment. When the crosshead will move from end to end of the bars, having contact with both their entire length, the bars may receive a very light coat of red marking. Shove the crosshead up and down them two or three times, and the marks upon the bars will denote if the bearing between the crosshead guides and the surface of the bars is even from end to end. During this adjustment the fit of the flanges of the crosshead against the edges of the bars requires watching, the marks being a sufficient guide. When properly fitted, get out the liners (as the small pieces, which are placed between the ends of the bars and the supports, are termed). To get the thickness of these liners, take wedges made of iron, wood or lead, and insert the thin end between the end faces of the bars and their seating upon the supports, forcing the wedges in with sufficient force to leave a mark upon them. By chalking the faces of the wedges they will exhibit the marks more plainly. The wedges should be inserted at each end and on both sides of the bar, the liners being got out a little thicker to allow for fitting.

In filing up the liner use either a surface plate or a straight edge, and file the liner faces hollow rather than rounding, for if filed rounding the guide bar may cant to one side in the bolting up, while if hollow the bar will be sure to bolt up solid. When the four liners are ready, put them in position between the bars and their seatings. Bolt the bars firmly in place, wipe them clean, and test them lengthways with the spirit level to ascertain if they are parallel with the bore of the cylinder. Place the level across the bars to test parallelism with the engine shaft. Note where further adjustment is necessary. Put marking upon the bars and move the crosshead up and down to ascertain how much the respective liners require reducing. After filing all the liners it is better before putting them in for the next adjustment to give them a light coat of marking, to show where they bear. At each trial of the bars the spirit level and the straight edge should be applied. The crosshead should be moved up and down the bars to ascertain by the bearing marks upon the surfaces how the crosshead guides fit. The fitting marks are a finer test than the spirit level, hence the last part of the fitting should be performed with strict reference to the bearing marks, both upon the bars and the crosshead as well as upon the liners; the crosshead flanges being adjusted and fitted at the same time as the face fitting.

The adjustment is correct when the gland is equally free and has an equal amount of play in the stuffing box at whatever part of the stroke the piston rod may be. In bolting up the bottom bars during the last part of the adjusting process, it is necessary to screw up the bolts to the same degree of tightness, for a little extra tightening in some of the bolts may cause the bars to spring out of true, if the ends of the bars or the seating for the liners is not practically true. To set the top bars place the crosshead in the middle of its stroke and lay the bars upon the crosshead guides. Then, with the wedges applied as before, ascertain the required thickness of the liners, one at a time, leaving them as previously a trifle thick, testing them on both the flat and the edge faces by marking placed on the surfaces, and moving the crosshead up and down, dispensing with the use of the spirit level and straight edge, and working entirely by the bearing marks. J. R.

To renew manuscripts, take a hair pencil and wash the part that has been effaced with a solution of prussiate of potash in water, and the writing will again appear, if the paper has not been destroyed.

NEW BOOKS AND PUBLICATIONS.

"FRET SAWING FOR PLEASURE AND PROFIT." H. T. Williams, Publisher. New York: Illustrated. Price 50 cents.

This is a complete handbook of fret sawing, valuable alike to the amateur and skilled artists for the hints and suggestions contained therein. It describes the various kinds of woods with their uses, and treats of each mechanical and artistic detail in the most minute manner. It is printed on fine paper and profusely illustrated throughout.

MONEY AND LEGAL TENDER IN THE UNITED STATES. By H. R. Linderman, Director of the Mint. G. P. Putnam's Sons. New York.

This volume contains in a brief and convenient form a complete history of the money used in the United States, of the various acts of Congress in regard to it, of the establishment of the mint, of the variations of the money standard, and the change from the double standard of gold and silver to the gold standard. Foreign coins, the paper currency, national currency, and the re-monetization of silver are all considered. As Mr. Linderman says, "until recently, the subject of bringing this currency from a credit to a specie basis has not received the attention which its great importance demands." The work will be found very timely and useful to the public in the examination of these financial questions.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE.

Franklin Fulkerson, Frankfort, Ind.—This is a new and ingenious fence, so constructed as to prevent cattle from putting their heads between said boards and riders and throwing off said riders. The general design is strong and substantial.

IMPROVED COTTON PLANTER.

Daniel W. Reed, Allenton, Ala.—The object of this invention is to provide for use in planting cotton a simple but highly efficient machine, in which the whole quantity of seed in the hopper will be agitated, and a portion thereof also rubbed between opposing surfaces for the purpose of separating its interlacing fibres and enabling it to discharge, in the desired manner, at the bottom of the hopper into the open furrow. The invention consists in employing vertically and reversely reciprocating seed-rubbers and dischargers, the same being arranged on opposite sides of the hopper and working in suitable guides. The invention also consists in providing the sides of the hopper with adjustable pieces or sections for regulating the quantity of seed discharged within a given time.

IMPROVED PLANT AND TREE PROTECTOR.

Julius O. Antisdale, Lake Harbor, Mich.—Ordinarily tubes of sheet metal, paper, and other opaque substances are used for protecting plants against the ravages of worms. The present inventor suggests an excellent improvement in the shape of a glass cylinder composed of two half sections, which are forced a few inches into the soil, so as to surround the plant. The earth is pressed closely about the cylinder to keep the two sections together without the use of a band.

IMPROVED FRUIT DRYER.

William S. Plummer, Portland, Oregon.—This invention consists in a case provided in its lower part with a lining set at a little distance from its walls, the large door, the small door, the cleats or sides to receive the fruit frames or trays, the doors, and the cover and cap to allow the moisture-laden air to escape, to adapt it for use in drying fruit. It dries the fruit rapidly and evenly, and is so constructed that it may be readily taken down, set up, and moved from place to place.

IMPROVED DROPPING ATTACHMENT FOR CORN PLANTERS.

Jacob W. Oberholtzer and Charles E. Wilcox, Hiawatha, Kan.—This is an attachment to corn planters that will mark the rows and drop the corn simultaneously. The apparatus is used by making a mark across the ends of the field and starting the dropping in the mark at each end of the field. Uniformity in the rows is thus secured. The construction is quite ingenious and novel.

IMPROVED DITCHING AND TILE-LAYING MACHINE.

Robert E. Nevin, Enon Valley, Pa.—This is an improved machine for tile ditches, laying the tiles, and filling the ditches. It may also be used for digging open ditches and making other excavations. A number of excellent improvements are embodied.

IMPROVED SEEDER AND PLANTER.

Uriah Baldwin, Isaac T. Shumard, and William K. Shumard, Stewartson, Ill.—This is an improved machine so constructed that it may be readily adjusted to plant the seed in drills or rows. A number of useful improvements are embodied, all of simple and ingenious construction.

IMPROVED VENTILATING GLASS SHADE AND COVER FOR PLANTS.

Semon J. Pardessus, New York city.—This is an ordinary glass shade having an opening in the top closed by a hinged plate in which are openings which can be open or shut at will. Its object is to protect plants while growing, and to aid in the development of buds and flowers.

IMPROVED ROAD SCRAPER.

James H. Edmondson, Valparaiso, Ind.—This road scraper is of the sulky type, and is so constructed that it may be easily operated by the driver from his seat to load and unload it. When loaded it may be swung beneath the axle and carried to any desired distance. It is an excellent machine for use upon roads in parks and country places.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED FIREPLACE GRATE.

Robert L. Mitchell, Huntsville, Ala.—This invention relates to certain improvements in open fireplace grates, and it consists in the particular construction of double back and sides, and in the combination with the inner back and sides of a detachable back plate for the fire pot which operates as a key to lock and hold the other parts in proper position.

IMPROVED STOPPING MECHANISM FOR LOOMS.

John Megson, South Adams, Mass.—The object here is to stop the motion of a loom in the event of the weft or filling running out or breaking, if such motion of the loom is permitted by the fork being operated by the end of the thread which has been left by the shuttle. Such weft or thread permits the motion of the loom to continue in two ways, namely, by getting entangled on the fork and also by lying in the box in such a position as to cause the fork to move. In both cases the loom will run as if there was filling in the shuttle, and if more than one kind of filling is being used an imperfect pattern will be produced, or it will be necessary to adjust the pattern chain. The new attachment breaks the thread off, and when it lies in the box it slackens it, taking away its resistance to the fork.

IMPROVED MACHINE FOR GUMMING LABELS.

Lazarus Morgenthau, New York city.—This consists essentially of an endless feed belt that conducts the labels to be gummed to an endless supply belt, to which the adhesive substance is fed from a suitable receptacle below by distributing rollers. A circular brush exposes all parts of the label to the action of the supply belt. A second revolving brush clears the labels from the pressure brush, and conducts them to an inclined clearing plate, and from the same to the place of use. These machines are excellently suited for applying paste to wall paper, stamps, labels, etc. One is in operation at the fair of the American Institute, and its working well substantiates the inventor's claims.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

William Harrison, Linneus, Mo.—This invention relates to an improvement in the class of safety car couplings, that is to say, couplings which are so constructed that the device for locking the link may be raised or lowered without requiring the operator to enter between the cars. The invention consists chiefly in providing a sliding case for each drawhead and constructing it with inclined shoulders and notches, whereby it is adapted to raise, and lock in the elevated position, the device that engages the link.

IMPROVED MACHINE FOR MAKING BARRELS.

William K. Hoback, Bentonville, Ark.—The staves are set at each end in a ring, or annular guide, and an iron band is lowered to surround and enclose the hoops about the middle of their length. The said band is adjustable and serves to clamp or compress the hoops tightly together. An annular anvil or heavy iron ring is lowered inside the barrel or hogshead to a point nearly opposite the outer adjustable band, and it serves to hold the staves in position, while a central hoop is being nailed on, and the points of the nails that secure the hoop are turned and clinched on the annular anvil.

IMPROVED RE-SAWING MACHINE.

John Lamb, Ottawa, Ontario, Canada.—This is a new resawing machine for splitting slabs, boards, or plank. It embodies an ingenious arrangement of adjustable feed works. The lumber is carried against a circular saw by rotation of rollers which follow the inequalities of board without imposing any undue strain on the feed.

NEW HOUSEHOLD INVENTIONS.

IMPROVED EXTENSION BED LOUNGE.

William E. Buser, Chillicothe, O.—This manufacturer has devised an improvement in the class of bed lounges having a sliding top. The object in view is to render the head of the false bottom self-supporting when the lounge is extended; to attach the false bottom to the true bottom, and support it by such means and in such manner as will enable it (when raised) to extend over the foot of the body of the lounge; to provide improved stops for preventing the top being detached from the body of the lounge when slided off the same to allow the false bottom to be raised.

IMPROVED WASHING MACHINE.

Aaron M. Cornelius, Oregon City, Oregon.—This machine has a corrugated roll that revolves over a bed consisting of two or more smaller corrugated rolls. There is a new arrangement of spring followers for carrying the smaller rolls up against the larger rolls, an improved arrangement of supports, and a device for fastening the machine in the tub. The principal advantages claimed are durability, the various parts adjusting themselves to wear, and superior strength.

IMPROVED CANDLESTICK.

Jesse Failing, Umatilla, Oregon.—This consists of an ordinary candlestick, but split centrally at its cylindrical part, so as to form two halves, that clasp the handle. The split stick is held together by a spring placed immediately below the rim, and retained there by suitable rests. The spring-acted top rim of the stick holds the candle firmly in place until it burns down to the stick, when, by the gradual heating up of the rim the pressure is relaxed, and thereby the interior spring forces the candle up gradually until entirely consumed.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

For Sale.—Brown & Sharpe U. Milling Machine; one 5 ft. Iron Planer and Turret Lathe. W.E. Lewis, Cleveland, Ohio.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

For Sale at $150.—New 12 in. Swing, 8 ft. bed, back geared, screw cutting, ind. feed, foot or power Lathe. W. E. Lewis, Cleveland, Ohio.

Wanted.—Light Second-hand T iron to lay ¼ miles track. Send prices to Potsdam (N. Y.) Lumber Co.

The Varnishes and Japans of Hyatt & Company, are, in the success they meet, noted for color, purity, and durability, with cheapness, giving them pre-eminent merit. Send for circulars and price list. Office 246 Grand street, New York.

Safety Linen Hose for factories, hotels, and stores, at lowest rates. Greene, Tweed & Co., 18 Park Place, N.Y.

New Lathe Attachments, such as Gear Cutting, Tap and Spline Slotting. W.P. Hopkins, Lawrence, Mass.

Steam Yachts, Engines, Boilers, and the Celebrated Central City Propeller Wheel. Wm. J. Sanderson, 21 Church street, Syracuse, N. Y

To Millwrights and Parties in want of Engines, Boilers, Shafting, Gearing, Pulleys, etc., upon receipt of specifications we will give you promptly bottom prices for same. B. W. Payne & Sons, Corning, N. Y.

For Sale.—18 in. Screw Cutting Lathe, $195; 17 in. do., $185; 16 in. do., $150; 5 ft. Planer, $275; 7 ft. do., $350; Heavy Punch and Shear, $600; at Shearman's, 132 N. 3d St., Philadelphia, Pa.

Bolt Forging Mach. & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Town & Village use, Comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Kreider, Campbell & Co, 1030 Germantown Avenue, Philadelphia, Pa., Machinists and Steam Engine Builders, Millstone Manufacturers, Contractors for Mills for all kinds of Grinding. Estimates furnished.

Paris Fair.—A Manufacturer and Exporter of Hardware and Agric'l Imps., exhibiting his own goods at the Paris Exposition, will exhibit and introduce into Foreign Markets for a moderate compensation, articles of Hardware, Woodenware, Iron, Agric'l Tools, and Machinery. Only one firm in each line of goods. Highest references given. Address "Exporter," P.O. Box 3,715, N.Y.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Best and Cheapest Wagon Tire Upsetter, only $12. Circular free. H. W. Seaman & Co., Millport, N. Y.

C. C. Phillips, 4,048 Girard Ave., West Phila., manufactures Vertical and other Burr Mills adapted to all kinds of grinding; also Portable Flouring Mills.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Small Fine Gray Iron Castings a specialty. Soft and true to patterns. A. Winterburn, 16 De Witt street, Albany, N. Y.

Tin Foil.—J. J. Crooke, 163 Mulberry St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Plumbers—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister Mf. Optician, 49 Nassau St., N. Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U.S.A.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

Models made to order. H. B. Morris, Ithaca, N. Y.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Best Machinists' Tools. Pratt & Whitney, Hartford, Ct.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

To Clean Boiler Tubes—Use National Steel Tube Cleaner; tempered and strong. Chalmers Spence Co., N. Y.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years constant use prove them stronger and more durable than wrought iron. See advertisement, page 334.

Emery Grinders, Emery Wheels, Best and Cheapest, Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Notes & Queries

Correspondents are reminded that we cannot notice anonymous communications, and that letters signed "constant reader," "old subscriber," or mere initials come under this rule. In many instances we prefer to reply to queries, especially when they are of a personal nature, by postal card addressed directly to the inquirer, and it is obvious that we cannot do so unless the full address is given. Many correspondents whose questions are not answered will find the reason in the foregoing.

(1) J. O. asks: What is the cheapest and most effectual method of separating iron from brass, when the two metals have become fused together? A. If small quantities of the alloy are to be operated upon, perhaps the following method will best serve the purpose: Fuse the alloy with an equal quantity of sulphur (or add the sulphur after fusion) and digest the cooled mass with a sufficient quantity of oil of vitriol, mixed with three parts of water and warmed for some time. This will dissolve the iron and remaining zinc, leaving the copper as a dark powder, which may be dried, roasted, mixed with an equal quantity of sal soda and charcoal, again roasted, and finally heated to whiteness to reduce and melt the copper. If it is desired to recover the iron, boil the solution, add a sufficient quantity of caustic lime in powder, or chalk, allow to settle, decant the liquid, mix the precipitate with twice its weight of charcoal powder, dry perfectly and fuse at a strong white heat. Fusing the alloy with the proper quantity of clean quartz sand at a white heat will slag the iron, volatilize the zinc, and, if a little copper be added, separate the copper.

(2) J. A. W. says: 1. I made an electro-magnet with 25 feet of the size of the wire sent (not insulated with either silk or cotton) on each bobbin, with ⅝ inch round Ulster iron for the cores; they were 1¾ inches long and would hold up 1½ lbs. I made the magneto-electric engine described on p. 201 SCIENTIFIC AMERICAN SUPPLEMENT, using the above magnet, but it would not work. What was the matter with the engine? Was the magnet long enough? How many feet and of what number of silk-insulated wire will I need to make the engine? A. Make the cores of ½ inch soft iron, about 2 inches long, and use enough of No. 28 silk-covered copper wire to make the helices an inch and a quarter in diameter. 2. Could I not make one that would work a small lathe with about 2 lbs. of wire on the magnet? A. No. 3. How would sal ammoniac do for the zinc fluid in the Bunsen or bichromate battery, with two cells of the bichromate battery? A. Dilute sulphuric acid is preferable.

(3) A. H. G. wishes to know (1) the manner of photo-engraving? A. There are several photo-engraving processes in use, generally based on the property possessed by certain compounds—as that of gelatin with chromic acid—of being insoluble when exposed in thin films to light. The films may be spread directly on the plate, slightly coated with wax or asphaltum, and after drying in the dark, exposed under the photo-negative; or on transfer tissue, and, after exposure, transferred to the plate. Treated with hot water the parts of the image unaffected by the light are dissolved, leaving in those portions the surface of the plate, or waxed surface, bare. The film may then be hardened by immersing the plate in alum water, after which the exposed surface may be etched with an acid, or acid salt (if the plate is of zinc), as sesquichloride of iron: first having removed wax or asphaltum with benzole. After etching, the image may be removed with hypochlorite of lime and boiling water, and the engraving perfected. The photograph is usually in line drawing. The name of nature-printing is applied to several processes. 2. How is nature-printing done? A. You should consult Vogel's "Chemistry of Light and Photography." 2. Can the impressions be made in gutta percha and paper, instead of wax and plaster? A. As we understand you, yes, in some cases.

(4) A. B. asks how he can have his hair restored? It has fallen out in patches all over his head. A. The following preparation for stimulating the scalp is recommended by Fox: Glycerin 3 drachms, lime water liniment 4 ozs., cantharides—tincture—3 drachms. Brush into the scalp with a stiff nail brush until irritation is set up.

(5) N. S. asks: What is the cheapest manner of making oil of salmon heads, liver, etc., and clarifying or refining same? A. The scrap may be thrown into a deep narrow cauldron filled with boiling water, and hot steam injected at the bottom for about fifteen minutes, transferred to an hydraulic press, and what oil there is expressed. The pressed scrap may be used as a fertilizer. The oil may be purified by agitation with hot water containing a few per cent of tannin, next with hot water and steam alone, and filtration through animal charcoal; or agitate with a dilute solution of blue vitriol and common salt, wash, and filter as before. Ordinarily, exposure to sunlight in shallow glass-covered trays will bleach it.

(6) I. C. G. asks: Why does the moon appear larger and less brilliant at the horizon than at the meridian? A. Larger because of comparison with terrestrial objects; less brilliant because of being seen through the denser or more hazy atmosphere close to the earth's surface.

Considering the difference between equatorial and polar radii of the earth, it would seem that the flow of the Mississippi river from its source to its mouth would be about 2½ miles up hill; how is it? A. If "up hill" means more or less distance from the earth's center, the Mississippi would present the paradox noted; but "up hill" is really elevation above the ocean level—which must be taken as the standard. In reality the river descends about 2 feet per mile, the elevation of the source being some 8,000 feet above the sea level.

(7) N. W. G. asks: What is the best way to bend plow handles? We have some trouble owing to their splitting. A. Cut a fine groove around the handle and bind them with copper wire.

(8) J. W. R. asks: 1. How can I make a mould for electrotyping from a wood cut, and how is it prepared? A. Use wax, melted sufficiently so as to take a fine impression of the cut. Dust the mould thickly with graphite, and suspend freely in the bath. 2. What can I do when sufficient copper has attracted the mould, to make it ready for mounting on wood blocks? A. Fill in the back of the electrotype with type metal and turn the edges neatly.

(9) F. F. W. asks: What will prevent black oil (say natural W. Va.) "Globe A" brand from working destructively on a sulphur joint under the bed plate of an engine? A. Give the joint a thick coat of equal quantities red and white lead mixed with varnish.

(10) C. D. N. asks: Does a toad throw off its skin? A. Yes, at intervals.

What position, east or west, north or south, is the best for the bed of a sleepless person? A. Beds in many hospitals are placed north and south, parallel to the magnetic meridian.

1. What will remove the effects of a wasp's sting? A. Ammonia. 2. How can we drive wasps from a house? A. You might try any insect powder, or smoke from burning coffee.

Can you give me a simple method for illustrating to a class of children the movements and phases of the moon? A ball hanging on a thread and moving round the head with a candle for the sun is simple, but is hardly satisfactory. A. We know of no simpler method than that suggested.

Has the sun any kind of a movement, and what is it? A. Three—an axial rotation, a motion about the center of gravity of the whole solar system, and a progressive motion in space toward the constellation *Hercules*.

What is the use of the dominical letter? A. For the purpose of determining when Easter falls and for other similar problems concerning the day of the week and the day of the year. It was early found convenient to place the first seven letters of the alphabet in succession against the days of the months, putting A to January 1 and repeating the seven letters as often as necessary until December 31. The letter which falls against the first Sunday in January will fall against every Sunday in the year and thus is the dominical letter for the year unless it be leap year. Finding the dominical letter enables one determine what day of the week a given date in the year is. See introduction in Episcopal Book of Common Prayer.

Does the expression W. by S. (west by south) mean west near the south? What does (S. S. W.) south-south west, mean? A. W. by S. is the first point of the compass to the southward of due west, and S. S. W. is the second point to the westward of due south. Other questions have been repeatedly answered in back numbers.

(11) W. K. R. asks: Would it be practicable to make a small steam boiler, 20 x 30 inches, of galvanized iron? If so, what thickness of iron would be required, and at what pressure would it be safe to run it? A. Such construction is very common. If the iron is ⅛ inch thick, a safe working pressure will be about 50 lbs. per square inch.

(12) Z. B. says: A. and B. are building an 18 inch pipe that is to have a fall of 60 feet. B. maintains that if the pipe is made taper, that with the same sized outlet he will have more pressure than if the pipe is 18 inches diameter the entire length. A. says not. Which of the two is right? A. We think A. is right; but the meaning of the question is not very clear as it is expressed.

(13) L. J. B. asks: Which, on a half mile curve of railroad track, is the longest rail, the inside or outside, or are they equal in length? A. The outside.

(14) F. E. C. asks: Is the point of cut-off equalized in the stationary engine? If so, how? A. It can be equalized by allowing a variation in the steam lead at the two ends of the stroke.

(15) H. M. A. says: I think of running a 1 inch pipe from my 30 horse power boiler into and up a 70 feet brick chimney, and attaching a whistle thereto. Would the apparatus be safe as a lightning conductor? A. Certainly not. Such attachments should terminate in the ground; never in the structure they are designed to protect.

(16) J. E. C. ask: Will I have to pay a government license to run a small skiff with a small engine on the Chemung river, which is not navigable or used for any commercial purpose? A. The steamers coming under the provision of the law are those "navigatingany waters of the United States which are common highways of commerce, or open to general or competitive navigation," and "all coastwise sea-going vessels, and vessels navigating the great lakes" (extracts from sections 4400 and 4401 of the Revised Statutes of the United States).

(17) J. E. L. asks for a simple and easy way to set a safety valve on a steam boiler, or how to go to work to find where to hang the pea? A. Take off the lever, balance it on a knife edge, and observe how far the point at which it balances is from its fulcrum. Lay off this distance from the center of a bar of uniform section. Place the center of this bar on a knife edge, lay off from the center, on the opposite side, a distance equal to the distance from the center of the valve stem to the fulcrum. At this point attach the valve and a weight equal to the pressure acting on the valve when it is to open. Attach the lever at the first point marked, and move the pea along the bar until it is balanced. See also question (9), p. 236.

(18) W. H. C. asks (1) how to take the tubes out of a locomotive boiler when the tubes are badly covered with scale, produced from lime water, without injuring the tube sheets? A. The tubes must be cut loose from the sheets, and then they can be drawn out by inserting rods in them, each rod having a washer at one end, and a thread at the other, passing through a crowfoot placed against the sheet. 2. Is there a scale extractor that will remove the scale from the tubes by using it in the boiler before undertaking to take the tubes out? A. The scale may be softened by filling the boiler with fresh water, heating it and then allowing it to cool slowly. If there is much scale, it may be very difficult to remove the first tube, but after that is out, a tool can be introduced to clean the second tube.

(19) A. H. asks how many feet the earth varies from a straight line per minute in its orbit? A. Considering the earth's orbit as a circle of average radius 91,500,000 miles, the variation would be roughly 700 miles, or 3,696,000 feet per minute. 2. Also how many foot lbs. of velocity it is supposed to have? A. About 35 thousand million trillions of foot tons per minute.

(20) W. P. R. asks how shoemaker's wax is prepared? A. Beeswax, 8 ozs.; tallow, 1 oz.; melt and add powdered gum arabic, 1 oz., and lampblack to color. We know of no special uses.

(21) N. A. W. asks for combination colors, not aniline, for wool goods, for green, blue, red, black, and yellow? A. *Black* for 50 lbs.—Prepare with 2¼ lbs. of chrome; boil ½ hour and wash in two waters. Dye with 20 lbs. logwood and 2 lbs. fustic. Boil ½ hour: 1 water, then a slight sour moderately warm; 1 cold water and finish out of a warm one softened with a little urine. *Yellow* for 40 lbs.—2½ lbs. bark, 2 lbs. tartar, 2 quarts muriate of tin. Enter at 150° Fah.; boil 30 minutes. *Grass green* for 50 lbs.—Boil 20 lbs. fustic, 7 lbs. extract of indigo, 1½ lb. tartar, 3 gills sulphuric acid. *Scarlet* for 50 lbs.—Boil 4 lbs. cochineal and 1¾ lbs. of bark. Add 3 lbs. tartar, 2 quarts scarlet spirits. Enter at 200° Fah.; boil 1 hour, wash well. Sour before dyeing either cold or warm. *Blue* for 50 lbs.—1 gill sulphuric acid, 3 ozs. extract of indigo, 1 lb. alum. Enter cold with one half of the extract; give the other half when the boiler warms. Bring to the spring.

(22) C. E. S. asks; What chemicals may be used for writing on colored paper which will take the color out, leaving a white line where the ink touches? A. 1 part muriatic acid and 20 parts starch water. Very dilute oxalic acid may also be used. Write with a stee pen.

(23) O. B. M. asks: What is the best and cheapest way to make lampblack? A. A conical funnel of tin plate, furnished with a small pipe to convey the fumes from the apartment, is suspended over a lamp fed with oil, tallow, coal tar or crude naphtha, the wick being large and so arranged as to burn with a full smoky flame. Large, spongy, mushroom-like concretions of carbonaceous matter form at the summit of the cone, and must be collected from time to time. The funnel should be united to the smoke pipe by means of wire, and no solder should be used for the joints of either.

(24) F. D. asks for a recipe that will remove rust, grease, and dirt from a gun barrel? A. Try turpentine. 2. Also a recipe to prevent the barrel from rusting when exposed to the weather? A. See reply to L. S. W., this issue.

(25) J. M. asks: What is rubber cement, and how to soften clothes wringer rolls, so that in putting them on they will not fit so tight as to rub all the cement off the spindle? A. Rubber cement is gutta percha dissolved in bisulphide of carbon. Try dipping the rolls in hot water.

(26) A. M. C. asks for a recipe for polishing shells, such as tortoise and sea shells? A. Marine shells are cleaned by rubbing with a rag dipped in hydrochloric acid till the dull outer skin is removed, washing in warm water, drying in hot sawdust and polishing with chamois leather. Those shells which have no natural polished surface may either be varnished or rubbed with a little tripoli powder and turpentine on wash leather, then fine tripoli alone, and lastly with a little fine olive oil, bringing up the surface with chamois as before.

(27) C. E. H. asks: What is the best article to use in connection with sal soda in the manufacture of washing crystal? A. The alkaline matter is reduced to a coarse powder and stirred up with liquid size, or with a decoction of linseed, Irish moss or British gum. It is then dried and crushed.

(28) Several correspondents inquire what relations parts specified in a recipe bear to the weights of the ingredients. We have repeatedly explained that parts mean "parts by weight." Thus a cement for cracked wood is composed of 1 part slacked lime paste and 2 parts rye meal—that is, any given weight of the paste and twice that weight in rye meal.

(29) L. S. W. asks for a formula for practical use, to prevent small articles of iron or steel from rusting? A. Warm the iron or steel and rub it with clean white wax. Heat again until wax is absorbed—then rub over with a piece of serge.

(30) F. G. asks: What kind of varnish is used, and how prepared, to varnish chromos, etc.? A. Any good picture varnish will answer for chromos. A coat of clear size is usually first applied.

(31) I. M. H. asks: What will preserve rope, on flag pole, from rotting, and at same time be flexible? A. Tar the rope or oil it with whale oil. Paint the pole with white lead.

(32) T. P. G. asks for a cement that will resist the action of vitriol, to coat pickle troughs? A. Use a concentrated solution of water glass.

(33) W. H. N. asks: What causes the different shades of gold jewelry, some being deep and others pale yellow? A. The different alloys used affect the color. Thus where silver alone is used with gold a green tinge results; copper alone produces a red tinge; but the copper and silver are more commonly mixed in one alloy, according to the taste of the jeweller. There are various mixtures for heightening the color of gold. For red gold use 4 ozs. melted yellow wax, and add in fine powder 1½ ozs. of red ocher, 1½ ozs. verdigris calcined till it yields no fumes, and ½ oz. of calcined borax. Mix well together, dissolve in water, and use as required. Etruscan gold coloring is obtained from a mixture of alum, 1 oz.; table salt, 1 oz.; saltpeter, powdered, 2 ozs.; and hot water sufficient to make the solution when dissolved about the consistence of thick ale; then add sufficient muriatic acid to produce the color desired. The article to be colored should be from 14 to 18 carats fine of pure gold and copper only, and free from coatings of tin or silver solder.

(34) J. W. S. asks for a cement for uniting leather and cloth nearly or quite waterproof? A. Dissolve gutta percha in bisulphide of carbon to thickness of molasses. Press the parts well together.

(35) D. R. E. asks for a glossy paint that will not taste in water pails? A. Use paint prepared with water glass.

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(36) T. L. D. and other correspondents ask what should be the proportion of core to wire in magnets for an electro-motor, and what size wire should be used? A. Core and wire should weigh the same. No. 16 gauge (American) wire is commonly employed.

(37) M. S. asks how to wind wire on the cores of a number of electro-motor magnets? A. Fasten in the toolpost of a lathe a piece of iron having a groove cut in it to receive the wire. Set the change gearing for the screw feed of the lathe to the pitch of thread corresponding to the thickness of the wire. Wind the magnets by running the lathe in one direction and reverse the motion of feed at each traverse.

(38) P. L. F. asks how to deodorize rubber? A. Cover the articles with charcoal dust, place them in an enclosed vessel, and raise the temperature to 94° Fah., and let it remain thus for several hours. Remove and clean the articles, when they will be found free from odor.

(39) J. S. says: I have a quantity of pure rubber ⅛ inch thick, that has been used for thumb cuts for taking the hair from skins, such as beaver, nutria, etc. Can you tell me what I can do with the rubber, as it is all pure? I want to melt it and run into moulds for making the same kind of thumb cuts again. A. Cut the rubber into small pieces and place in the proportion of 100 lbs. in a well closed boiler with 10 lbs. bisulphide of carbon and 4 ozs. absolute alcohol, well stirred; then close the boiler and leave the material to soak for a few hours. It becomes a soft doughy mass, which, after being ground and kneaded, is fit to be formed with any shape, when the solvent will evaporate.

(40) M. T. wants to know the proper weight of a chipping hammer, and how long the handle should be? A. Weight 1¾ lbs. for heavy chipping, 1 lb. for light chipping; length of handle 15 inches.

(41) L. G. A. says: My sledge hammer comes off its handle; how can I prevent this? Iron and wood wedges do not answer. A. Make the eye of the hammer smallest in width at the middle, when either a wooden or iron wedge will hold it permanently.

(42) B. F. asks: What is the best material for grinding brass plugs? A. The burnt sand from the middle of a brass casting core.

(43) H. N. M. asks: How can I prevent taps from splitting and hardening? A. Heat the water in which they are quenched to 100°.

(44) H. E. M. asks: What material can I use to braze a brass flange on a copper pipe? A. Commercial brazing spelter mixed with borax and water.

(45) J. R. inquires for a good waterproof varnish for harness? A. India rubber, ½ lb.; spirits turpentine, 1 gallon; dissolve to a jelly, then take hot linseed oil equal parts with the mass and incorporate them well over a slow fire.

(46) E. T. C. asks: How can I take old wine and fruit stains out of linen? A. Rub the part on each side with yellow soap. Then lay in a mixture of starch in cold water very thick, and expose the linen to the sun and air till the stain comes out. If not removed in three or four days, rub that off and renew the process. When dry, it may be sprinkled with a little water.

(47) T. B. asks: What will temper steel when the metal will not temper readily when dipped at red heat? A. Add salt to the water.

(48) M. C. asks how to caseharden nuts? A. Finely powder prussiate of potash. Get the nuts red hot, coat them with the powder, put them again in the fire until the powder fuses, and then dip them in water.

(49) E, T. L. asks how he can test to discover whether his planer planes true? A. Take a fine finishing cut on a long casting, turn the casting on its edge and adjust it to touch the point of the tool at each end. Then try the point of the tool in the middle, when any hollowness or roundness will become at once apparent.

(50) A. F. inquires how he can cut out a deep, square, small hole, true? A. By drifting with a square serrated hardened steel plug driven through with a hammer. Lubricate freely.

(51) F. S. asks for a varnish to restore faded rubber goods? A. Use black japan varnish diluted with a little linseed oil.

(52) M. C. H. asks for the best manner of cleaning watch pinions? A. Pith from the stalk of the common mullein is the best material, and is better than cork. It should be obtained from the dry stalk in winter.

(53) B. R. asks what the "liquid foil" is that is used for silvering glass globes? A. Lead, 1 part; tin 1; bismuth, 1. Melt, and just before it sets add mercury 10 parts. Pour this into the globe and turn it rapidly round.

(54) M. C. asks for a recipe for liquid black lead polish? A. Black lead, pulverised, 1 lb.; turpentine, 1 gill; water, 1 gill; sugar, 1 oz.

(55) I. L. asks: Will carbon points do to use in a brace, to mark sheet iron through a templet, to make a mark same as a center punch? A. Yes.

(56) R. J. F. asks if the pendulum can be accelerated one second per day, by putting on an ounce weight? A. Not without virtually shortening the pendulum, that is, by a different distribution of the weight on the bar. For pendulums of the same length, the time of oscillation is independent of the nature or weight of the material—pendulums of metal, glass or wood, all being of the same length, under like conditions will oscillate in the same period of time.

(57) C. H. D. says: I have a machine for running emery wheels, the boxes of which are so worn by continual use as to need re-Babbitting, though the shaft is still smooth and good. Can you give directions for doing this in the most approved way? A. First set the shaft up in its place, close up the ends of the bearing with putty, and pour the lower half of bearing, the Babbitt being at a low red heat, and there being a small piece of rosin placed beneath the shaft to make the Babbitt flow well. Then put a piece of paper on the joint of bottom bearing, put on the cap, stop up the end with putty, and pour the Babbitt through the oil hole. It will aid the flow of the Babbitt to heat the shaft.

(58) J. E. G. asks how to temper gun lock springs? A. Make the springs red hot and cool them off in water, then fry them in lard oil over a fire until they will blaze freely.

(59) C. L. asks if there is any way to remove old grease that has become hard and dry on the bright parts of our engine? A. Scrape off the grease with a triangular scraper.

Also for a good recipe for making a cement to fill the holes and seams of millstones? A. Try crushed stone grit 20 parts, litharge 2 parts, quicklime 2 parts. Mix with linsced oil.

(60) M. L. C. asks for a good paint for blackboards? A, Mix together common glue, 4 ozs.; flour of emery, 3 ozs., and just lampblack enough to give an inky color to the preparation. Dissolve the glue in 1½ pints of warm water, put in the lampblack and emery, stir till there are no lumps, and apply to the board with a smoothly rolled woolen rag. Three coats are needed.

(61) F. T. asks how to remove burrs easily from the heads of cold chisels? A. Rest the head upon a block of iron and strike the burrs from the under side, and they will break readily and easily off.

(62) M. H. inquires how he can true up his carpenter's grindstone? A. Use a ¾ inch bar of iron or a gas pipe for a turning tool, held below the center of the stone.

(63) E. T. P. wants to know how to remove rust from small hollow castings? A. Dip in dilute sulphuric acid, 1 part of commercial acid to 10 water: wash in hot lime water, and dry in the tumbler with dry sawdust.

(64) M. T. says: How can I reduce the elasticity of a bar spring? A. File off a very thin scale from the surface.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. A. S.—The asbestos is of good quality, and will bring a fair price in the market. Asbestos is used for fireproof feltings, varnishes, cements, paints, for engine and boiler packing, and in the manufacture of a fireproof cloth and paper, etc. Dealers will address you.—S. D. H.—It contains large percentages of copper and zinc, and small amounts of iron, antimony, and alumina. The natural occurrence of this alloy (brass) is doubtful. You should send larger specimens and further particulars if possible.—C. P.—Send a sample of the magnesia salt.—O. F. F.—The sulphide contains a little copper, nickel, and arsenic. Silver was not detected. It is not of much value.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

Who makes electric lights?

Who sells carbon points?

Who manufactures ornamental iron work, such as brackets?

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 16, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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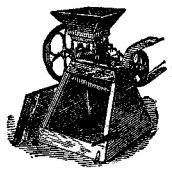

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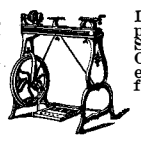

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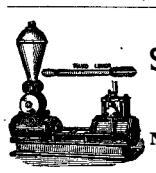

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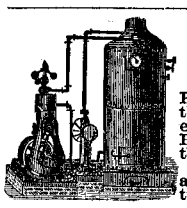

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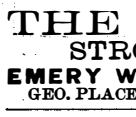

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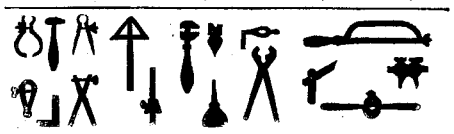

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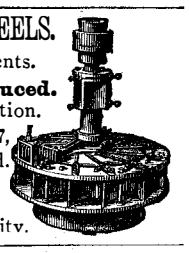

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